INVESTIGATION OF THE EFFECT OF STIFFNESS OF MEMBERS UPON THE SOLUTION OF VIERENDEEL TRUSSES

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by

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Introduction

A Vierendeel Truss is composed of a series of rectangular or trapezoidal panels without diagonal members. It is named for its inventor, Professor Arthur Vierendeel of the University of Louvain in Belgium. This type of truss has been popular in Europe, particularly in Belgium, since 1896 when the first bridge of this type was built in that country. In the United States its use to date has been limited to concrete viaduct bents, small roof trusses, and rigid frame foundations for buildings. It has been reported that a bridge using a concrete Vierendeel Truss system has been built recently on the West Coast, but as yet there is no printed matter available on that project.

The Vierendeel presents an exceptionally good appearance, the elimination of diagonals allowing a very clean looking structure. Its slow adaption in this country may be attributed to two factors; (1) until recently the only methods of solution were extremely long and tedious, sufficiently so to discourage only the most able and experienced in the field of structural design, and (2) the use of this truss has been so limited in this country that very few examples are available from which to make an intelligent investigation of the economic aspects of the problem.

METHOD OF SOLUTION

The method of solution used throughout this thesis was an application of slope deflection as outlined by Mr. A. Amirikian in his "Analysis of Rigid Frames". While there are other methods available for the solution of Vierendeel trusses it was felt that the procedure outlined by Mr. Amirikian was the simplest and most direct approach to the problem published to date. Inasmuch as his text has become a standard addition to all libraries of treatises on Indeterminate Structures, none of the derivations will be presented here and only a brief outline of the basic formulae and procedures will be given.

By way of simplifying the fundamental moment equation of a member having constant moment of inertia and modulus of elasticity

$$M_{AB} = 2E\frac{I}{H}\left(2\theta_A + \theta_B - 3\frac{\Delta}{L}\right) - FM_{AB}$$

the following abbreviated form is used

$$M_{AB} = K\left(A + \frac{B}{2} - R\right) - FM_{AB}$$

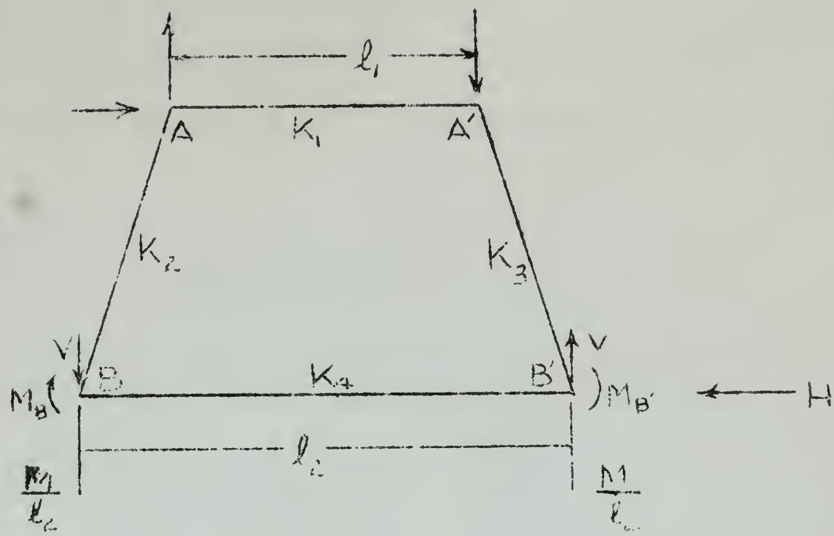
where

$$K = \frac{I}{L} \qquad B = 4E\theta_B$$

$$A = 4E\theta_A \qquad R = 6E\frac{\Delta}{L}$$

This simplification is used throughout the solution and greatly reduces the tediousness of the more complex equations.

Upon connecting four of these beams to form a panel and a series of panels to form a truss, the interdependence of the members and joints becomes pronounced. In order to consider the effect of varying stiffnesses in members forming or adjacent to a joint on both the moment at the joint and the deflection in the beam, expressions are developed for each joint encountered. These expressions will be known hereafter as the Joint and Deflection Equations. Likewise the moments obtained in the solution of any joint will vary widely with the shape of the panel, moments and shears applied and location of application, and the stiffnesses of the panel under consideration. In order to take these variables into consideration, Load Constant Equations are derived for each joint. Upon solution of these equations the load constant is equated to the Joint and Deflection equations which are then solved to find the deflection angles of the joints and the deflection of the adjacent member. Because of its basic nature the fundamental expression for the load constants of a typical panel are reproduced here in part.



(a) $M_B + M_{B'} = Vl_2 - M$

(b) $M_A + M_{A'} + M_B + M_{B'} = V(l_2 - l_1) - Hh$

Substituting V from (a) in (b)

(c) $M_A + M_{A'} + (1-m)(M_B + M_{B'}) = mM - Hh$

where

M = overturning moment of the external forces taken about the bottom of the panel.

H = shear, i.e., the sum of the lateral forces above the panel.

V = vertical reaction just above the bottom joints of the panel.

M_A = end moments at top.

M_B = end moments at bottom.

Q = values of load constant for joint or panel under consideration.

$$m = \frac{l_2 - l_1}{l_2} \qquad n = \frac{l_1 - l_2}{l_1}$$

By substituting the right hand part of equation (c) in a previously developed shear expression for a typical joint equation we arrive at load constants for a typical panel

$$Q \text{ of } R = \frac{Hh - mM}{(2-m)(k_2-k_3)}$$

$$Q \text{ of } A = \frac{(nk_1-k_2)(Hh-mM)}{(2-m)(k_2-k_3)}$$

$$Q \text{ of } B = \frac{k_2\ (mM - Hh)}{(2-m)(k_2 - k_3)}$$

Further importance is attached to equation (c) inasmuch as it acts as a check for the moment values obtained in the solution of any panel.

The procedure for the solution of Vierendeel trusses is an adaptation of this single panel solution. In order to avoid the difficulty of an exact solution the truss is first treated as a system of separate and independent panels. Each panel is solved for its own load neglecting moment introduced from other panels via the joints. To compensate for the error introduced in the original computation the solution isrepeated, this time using the moments obtained from adjacent panels as the new load constants for the panel being solved. The procedure is repeated, again interchanging moment increments between panels. Inasmuch as these increments diminish in size rapidly, two corrections will ordinarily provide a solution of sufficient accuracy.

The final moment will be the algebraic sum of the original moment determination and the successive increments.

For the Vierendeel truss used in this design with all loads applied at the panel points and the upper and lower chords having the same stiffness ratio, the deflection angles of the top chord joints will equal those of the respective bottom chord joints, and the joint and deflection equations become:

$$1.5K_1 - K_2 - \frac{(3 - m)(nk_1 - k_2)}{2(2 - m)} \; A -$$

$$\frac{k_2}{2} - \frac{(3 - 2m)(nk_1 - k_2)}{2(2 - m)} \; B = -Q_A$$

$$k_2 - 1.5K_4 - \frac{(3 - 2m)k_2}{2(2 - m)} \; B -$$

$$\frac{k_2}{2} - \frac{(3 - m)k_2}{2(2 - m)} \; A = -Q_B$$

$$R_1 = \frac{(3 - m)A - (3 - 2m)B}{2(2 - m)} - Q_{R1}$$

These equations, with appropriate K and angle notation are set up for each of the eight panels and equated to the corresponding load constants as obtained from the following formulae:

$$-Q_A = \frac{(nk_1 - k_2)(mM_1 - H_1 l_1)}{2(2 - m)k_2}$$

$$-Q_B = \frac{(H_1 l_1 - mM_1)}{2(2 - m)}$$

$$Q_{R1} = \frac{H_1 l_1 - mM_1}{2(2 - m)k_2}$$

The two equations in A and B obtained from the solutions of these sets of equations are then solved simultaneously and the value for R_1 determined. Substituting in the fundamental moment formulae

$$M_{AB} = K\left(A + \frac{B}{2} - R_1\right)$$

$$M_{BA} = K\left(B + \frac{A}{2} - R_1\right)$$

the original moment values for the panel are obtained. These moments are then corrected and the sum of the original moment plus corrections give us the final moment values.

Influence lines were plotted for the final moment values and design moments based on the combined loadings of one E-60 railroad rail and one lane of H15 - S12 - 44 highway loading were computed.

PURPOSE

The purpose of this investigation is to determine the influence of the assumed stiffnesses of the members upon the eventual design of the truss.

In the design of a Vierendeel truss by the method previously described, the first step is to assume a basic truss and loading system. A solution is then worked for this primary system, corrected for the actual loads and conditions, and the solution repeated with appropriate corrections to arrive at the final design, usuall three or more solutions being required.

Upon embarking upon this type of solution, the engineer is faced with two fundamental assumptions, (a) the loading to be used, and (b) the stiffnesses to select for his members. The first of these may be handled in the conventional manner, i.e. assume a loading of one kip and compute values for plotting influence lines to which he may later apply his design loads.

The second assumption, selecting appropriate stiffnesses for his members, presents a more difficult problem. Unfortunately so little material has been published on Vierendeel trusses in this country that there is little to guide him in this step.

Likewise the rarity of this type of structure in the United States makes it extremely unlikely that he could obtain any useful data on existing trusses of this type. Obviously it is up to the engineer to make such assumptions as he sees fit. In order to do this properly he should, of course, have some advanced knowledge of the distribution of moments throughout the truss in order that he could correctly proportion his stiffnesses to their appropriate moments. Previous experience lacking, he will be forced to estimate the probable moment intensities and select stiffnesses accordingly. This procedure leaves much to be desired, for regardless of a man's previous experience it is not to be expected that he could closely approximate the distribution of moments in a truss entirely unfamiliar to him, and his stiffness values will be subject to the same degree of uncertainty.

The question now arises as to the degree in which the assumed values of stiffnesses will affect the solution of the truss. It will be noted that the stiffness factor K occurs in four of the six basic equations for the solution, and it might be supposed that any wide variation in the true and assumed values of K would produce a similar

variation in the moment values obtained. It is the purpose of this thesis to determine the effect of widely varying stiffness values upon moments in a typical Vierendeel truss. The case selected was for a 240 foot lift span for a lift bridge across the entrance to a harbor inlet. The span is to carry one lane of highway traffic on each side of a single track standard gauge railway.

FIRST SOLUTION

For the first solution K values were chosen primarily from sample problems accompanying an article on Vierendeel trusses by Mr. Dana Young in the 1937 Proceedings of the A. S. C. E. Whether or not Mr. Young intendedthat the stiffness values in his problem should closely approximate actual conditions is unknown. On the condition that these values might approximate the trend of moment distribution, our assumed values were made to follow a similar pattern of variation.

SECOND SOLUTION

For the second solution the values of K were arrived at by using the moments obtained in the first solution. Since

$$K = \frac{I}{L} = \frac{Mc}{fL}$$

it was possible to solve directly for a value of K, inasmuch as members of constant depth (30") were proposed to improve the appearance of the truss and f and L were known values. In this way it was possible to determine the effect of closely approximating moment and stiffness values throughout the truss.

THIRD SOLUTION

For the third solution all K values were assumed to be unity. It was felt that since both moment and stiffness values vary throughout the truss that by holding one of these constant it might be possible to observe the variation of the other. In this way the stiffness values of the second set of computations of any truss might be made to closely approximate the stiffnesses required by the actual moments and thus expedite and simplify the final design of the truss.

FOURTH SOLUTION

For purposes of contrast the stiffness values of the fourth solution were taken exactly opposite to those of the first solution. In other words the same numerical values were used but varying in an inverse order of the first solution. In this way it was hoped to observe the effect of the direction of variations of stiffness values upon the moments computed.

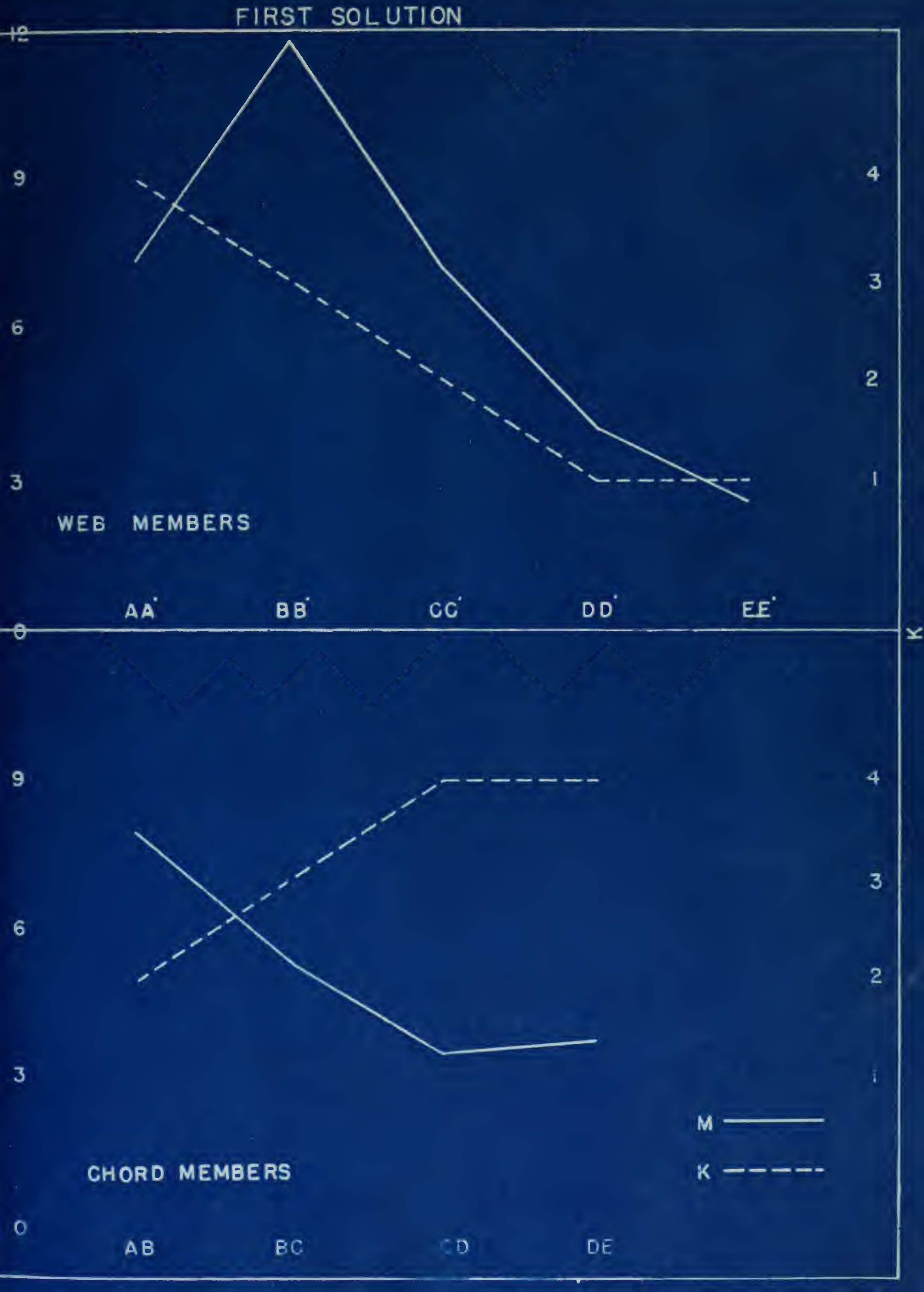
DESIGN MOMENTS

Member	Set 1		Set 2		Set 3		Set 4	
	K	M	K	M	K	M	K	M
AA'	4	7,362	160	7,222	1	7.689	1	7,987
BB'	3	11,745	232	11,762	1	10,600	1	9,030
CC'	2	7,243	136	7,575	1	7,781	2	8,497
DD'	1	4,046	74	4,447	1	5,170	3	5,844
EE'	1	2,593	47	3,000	1	3,282	4	3,435
AB	2	7,958	200	7,222	1	7,689	4	7,987
BC	3	5,360	134	5,492	1	5,465	4	7,329
CD	4	3,548	90	3,529	1	4,043	3	4,436
DE	4	3,790	95	2,877	1	3,020	2	2,986

For purposes of clarity the tabulated results of the moment solutions have been put in graph form on the following pages. Taking web and chord members seperately the values of moment and stiffness were plotted for each member for a given solution. The plotted points were then connected in order to indicate the trends of variation of both moment and stiffness. With one exception the moments and stiffnesses as plotted represent the actual values obtained and used in the solution. The one exception is in the case of the second solution. Here the values of K ranged from 200 to 47 and would have been at best unwieldy to plot on the scale adopted. Inasmuch as the numerical value of K appears to affect the solution only in its relative size compared to the other K values the K's for this solution were plotted on a relative scale. By taking K = 47 as unity the other K values were reduced to the same relative scale by dividing by 47, greatly simplifying plotting operations and presenting a better method of comparison with the other solutions.

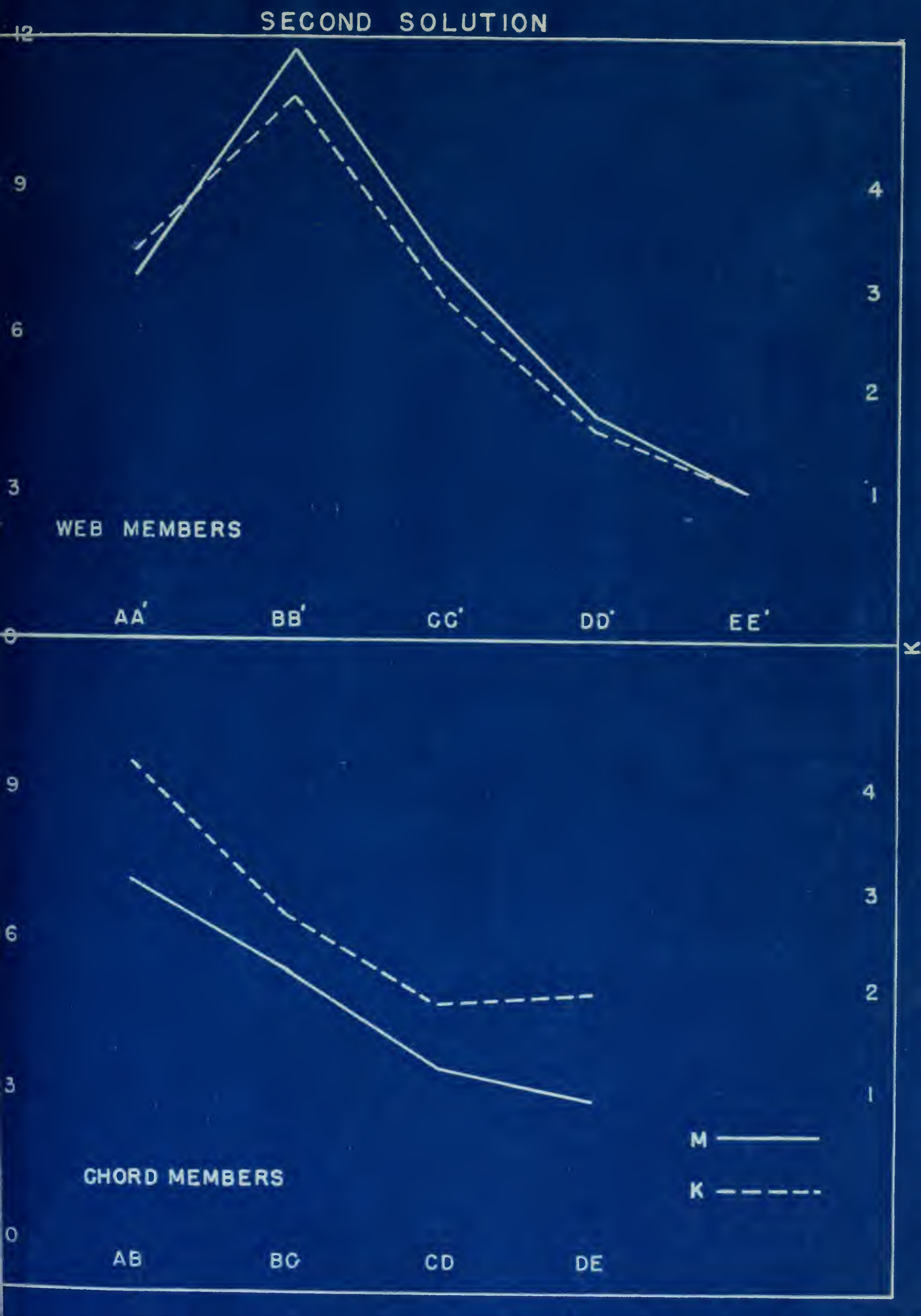
In examining the first solution curves there is little evidence to indicate any direct relationship in the variation of the K values assumed and

the moments obtained. In the case of the web members, CC' and DD' have similar relationships of moment and stiffness. There is an inverse relationship occurring in the case of the other three members. As for the chord members, the inverse relationship exists throughout; high moment values accompanying low stiffness values and vice versa.



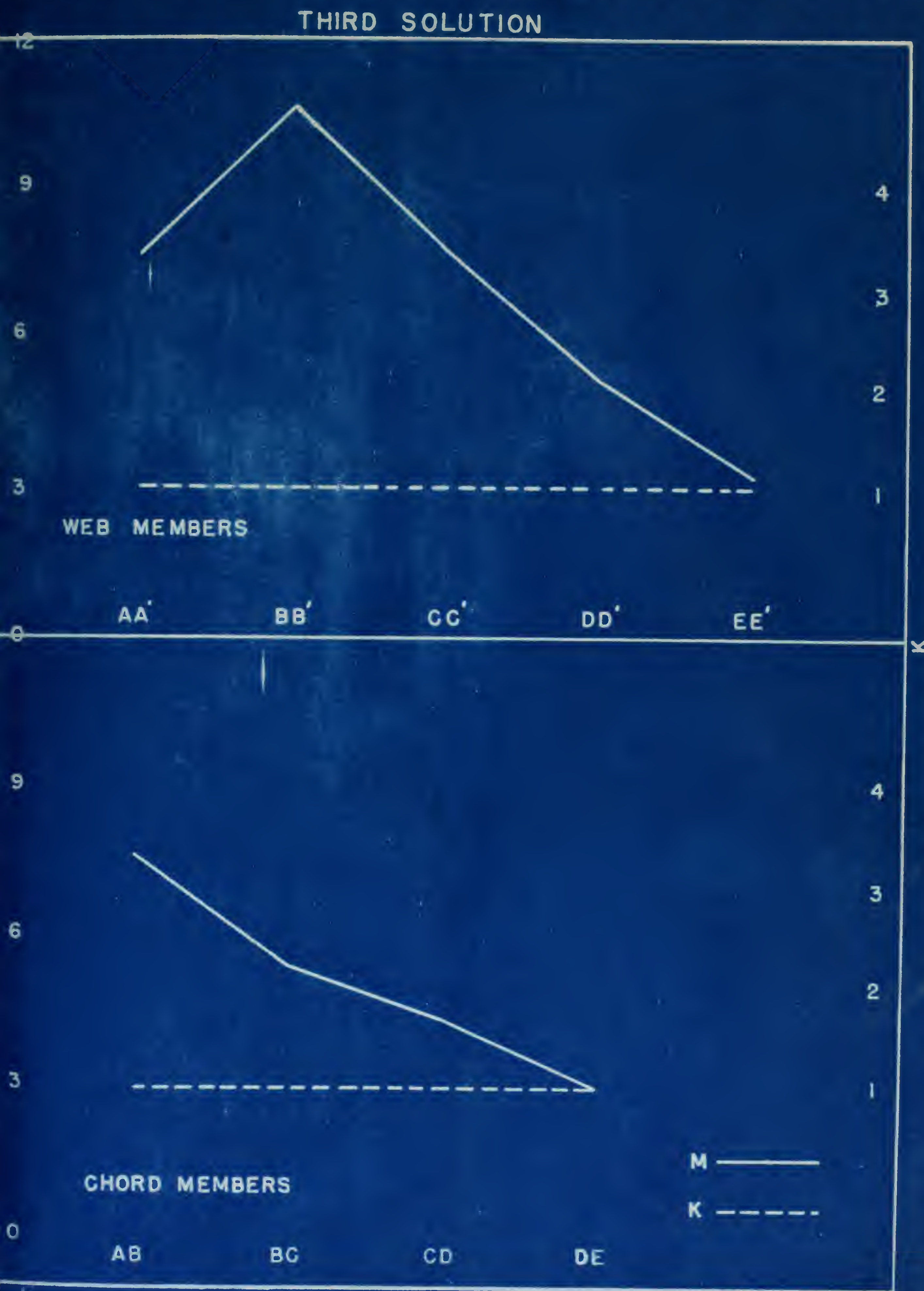
FIRST SOLUTION
12
9
6
3
0
4
3
2
1
K
WEB MEMBERS
AA' BB' CC' DD' EE'
9
6
3
0
4
3
2
1
CHORD MEMBERS
AB BC CD DE
M
K

The second solution represents a case in which the general trend of moment values closely follows the trend of the stiffness values assumed, with the sole exception of member DE. It is to be noted that there is no proportionality or direct relationship between the values of K and M. While the picture thus presented might seem to indicate a general tendency for moment values to follow stiffness assumptions, it must be remembered that the stiffness values for this solution were obtained directly from the moment values of the previous solution. In effect the moment values have changed but little and by the nature of their assumption it is to be expected that the stiffness values would vary in much the same way as the moment values.



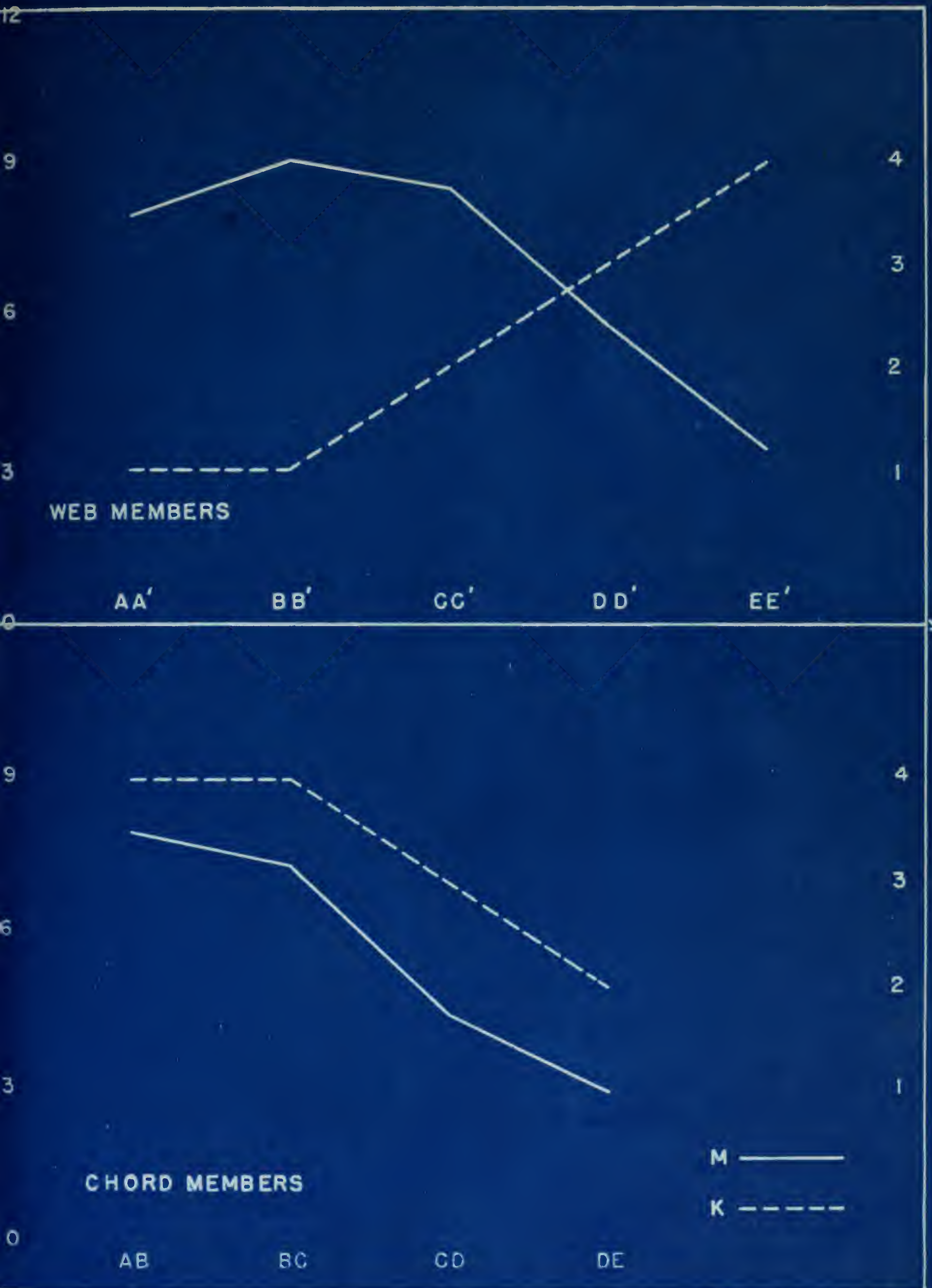
SECOND SOLUTION
12
9
6
3
0
9
6
3
0
4
3
2
1
4
3
2
1
K
WEB MEMBERS
AA' BB' CC' DD' EE'
CHORD MEMBERS
AB BC CD DE
M
K

The third solution is unique in that it presents an unvarying stiffness curve, all values of K being unity. It is to be noticed that in neither size nor pattern of variation do the moment values differ substantially from the previous solutions. At no place do either of the moment curves display any tendency to follow or parallel the trend of the K values assumed.


THIRD SOLUTION
12
9
6
3
0
4
3
2
1
K
WEB MEMBERS
AA'
BB'
CC'
DD'
EE'
9
6
3
0
4
3
2
1
CHORD MEMBERS
AB
BC
CD
DE
M
K

The fourth solution graph represents a system of stiffness values assumed in an exactly inverse order of those chosen for the first solution. Contrary to the results obtained in that solution we now find that the chord moments tend to follow the same general pattern as their corresponding K values while the web members follow a completely dissimilar path from their K values. As before there is but little variation in either the size or trend of the moments obtained as compared with the resultant moments of the first solution.

FOURTH SOLUTION



CONCLUSIONS

The results obtained from the four solutions presented show but one common trend, i.e. in no case do the resultant moments of any solution differ widely from those of any other solution. Conversely the stiffness values assumed for any one solution differ widely from those of all other solutions. No relating tendencies are disclosed, a lower stiffness value does not in every case bring a lower moment nor does a higher stiffness value display any significant effect on moments obtained. Likewise a change in the direction of variation of stiffness values seems to have little effect on the moments obtained. Therefore it must be concluded that the size, direction, or degree of variation of assumed values of stiffness of members does not materially affect the moments obtained in the first solution of a Vierendeel truss by this method.

In view of these conclusions it is recommended that in the solution of trusses by this method the first solution be worked with the assumption of all K values as unity. Such an assumption would permit a simpler and quicker solution of the truss with no loss of accuracy.

.0866	.0443	.0482	0	0	.0482	.0443	.0866
.0942	.0463	.0507	0	0	.0507	.0463	.0942
.875	-.125	-.125	-.125	-.125	-.125	-.125	-.125
26.25	22.50	18.75	15.00	-15.00	-11.25	-7.50	-3.75

Panel 1

$$-Q_A = \frac{(.0942x4 - 2)(.0866x26.25 - .875x30)}{2(2 - .0866)2} = 5.32$$

$$-Q_B = \frac{(.875x30 - .0866x26.25)}{2(2 - .0866)} = 6.27$$

$$Q_{R1} = \frac{(.875x30 - .0866x26.25)}{2(2 - .0866)2} = 3.14$$

Panel 2

$$-Q_B = \frac{(.0463x3 - 3)(.0443x22.5 - .125x30)}{2(2 - .0443)3} = -1.16$$

$$-Q_C = \frac{(-.125x30 - .0443x22.5)}{2(2 - .0443)} = -1.21$$

$$Q_{R2} = \frac{(-.125x30 - .0443x22.5)}{2(2 - .0443)3} = -0.40$$

Panel 3

$$-Q_C = \frac{(.0507x2-4)(.0482x18.75+.125x30)}{2(2-.0482)4} = -1.16$$

$$-Q_D = \frac{(-.125x30-.0482x18.75)}{2(2-.0482)} = -1.19$$

$$Q_{R_3} = \frac{(-.125x30-.0482x18.75)}{2(2-n)4} = -.30$$

Panel 4

$$-Q_D = \frac{(0-4)(0+.125x30)}{2(2)4} = -.94$$

$$-Q_E = \frac{(-.125x30-0)}{2x2} = -.94$$

$$Q_{R_4} = \frac{-.125x30-0}{2(2)4} = -.23$$

Panel 5

$$-Q_E = \frac{-.125x30}{4} = -.94$$

$$-Q_F = \frac{-.125x30}{4} = -.94$$

$$-Q_{R_5} = \frac{-.125x30}{4x4} = -.23$$

Panel 6

$$-Q_G = \frac{(.0507x2-4) - (.0482x 11.25 - .125x30)}{2(2 - .0482)4} = -.80$$

$$-Q_F = \frac{(-.125x30 + .0482x11.25)}{2(2-.0482)} = -.83$$

$$-Q_{R_6} = \frac{(.125x30 + .0482x11.25)}{2(2-.0482)4} = -.20$$

Panel 7

$$-Q_H = \frac{(.0463x3 - 3)(.0443x-7.5 - -.125x30)}{2(2 - .0443)3} = -.083$$

$$-Q_G = \frac{(-.125x30 - .0443x-.75)}{2(2 - .0443)} = -0.87$$

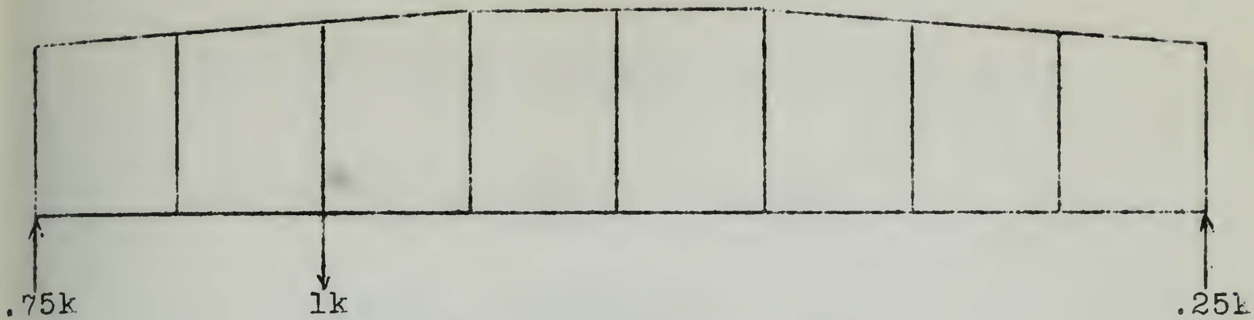
$$-Q_{R_7} = \frac{(.125x30 - .0443x - .75)}{2(2 - .0443)3} -0.29$$

Panel 8

$$-Q_I = \frac{(.0942x4 - 2)(.0861x-3.75 - -.125x30)}{2(2 - .0861)2} = -0.73$$

$$-Q_H = \frac{(-.125x30 - .0861x-3.75)}{2(2 - .0861)} = -0.90$$

$$Q_{R_8} = \frac{(-.125x30 - .0861x - 3.75)}{2(2 - .0861)2} = -0.45$$



.0866	.0443	.0482	0	0	.0482	.0443	.0866
.0942	.0463	.0507	0	0	.0507	.0463	.0942
.75	.75	.25	-.25	-.25	-.25	-.25	-.25
22.5	45.0	37.5	30.0	-30.0	-22.5	-15.0	-7.50

Panel 1

$$-Q_A = \frac{(.0942x4 - 2)(.0866x22.5 - .75x30)}{2(2 - .0866)2} = 4.56$$

$$-Q_B = \frac{(.75x30 - .0866x22.5)}{2(2 - .0866)} = 5.38$$

$$Q_{R_1} = \frac{(.75x30 - .0866x22.5)}{2(2 - .0866)2} = 2.69$$

Panel 2

$$-Q_B = \frac{(.0463x3 - 3)(.0443x45 - .75x30)}{2(2-.0443)3} = 4.98$$

$$-Q_C = \frac{(.75x30 - .0443x45)}{2(2 - .0443)} = 5.23$$

$$Q_{R_2} = \frac{(.75x30 - .0443x45)}{2(2 - .0443)3} = 1.74$$

Panel 3

$$-Q_C = \frac{(.0507x2 - 4)(.0482x37.5 + .25x30)}{2(2 - .0482)4} = -2.33$$

$$-Q_D = \frac{(-.25x30 - .0482x37.5)}{2(2 - .0482)} = -2.38$$

$$Q_{R_3} = \frac{(-.25x30 - .0482x37.5)}{2(2 - .0482)4} = -.59$$

Panel 4

$$-Q_D = \frac{-4(0 + .25x30)}{4x4} = -1.87$$

$$-Q_E = \frac{(-.25x30 - 0)}{4} = -1.87$$

$$Q_R = \frac{(-.25x30 - 0)}{4x4} = -.47$$

Note: The only term that changes is $(H_1L_1 - mM_1)$ and since this is doubled when the load is at panel point 2, it is tripled when the load is at panel point 3, etc. The following constants are derived by multiplying those obtained when the load was at PP1 by the factors 2, 3,&4.

Panel 5

$$-Q_E = -1.88$$

$$-Q_F = -1.88$$

$$Q_{R_5} = -.47$$

Panel 6

$-Q_G = -1.60$

$-Q_F = -1.64$

$Q_{R_6} = -.41$

Panel 7

$-Q_H = -1.67$

$-Q_G = -1.75$

$Q_{R_7} = -0.58$

Panel 8

$-Q_I = -1.45$

$-Q_H = -1.79$

$Q_{R_8} = -0.90$

Load at PP3

Panel 5

$-Q_E = -2.81$

$-Q_F = -2.81$

$Q_{R_5} = -0.70$

Panel 6

$-Q_F = -2.47$

$-Q_G = -2.40$

$Q_{R_6} = -0.62$

Panel 7

$-Q_G = -2.62$

$-Q_H = -2.50$

$Q_{R_7} = -0.87$

.0866	.0443	.0482	0	0	.0482	.0443	.0866
.0942	.0463	.0507	0	0	.0507	.0463	.0942
.625	.625	.625	-.375	-.375	-.375	-.375	-.375
18.75	37.5	56.25	45.0	-45.0	-33.75	-22.5	-11.25

Panel 1

Formulae (110f)&(122a) modified by the application of constants for terms involving only M, n, K_1, and K_2. These constants found and checked in solution for two previous loadings.

$$-Q_A = (-.222)(.0866\text{x}18.75 - .625\text{x}30) = 3.81$$

$$-Q_B = \frac{(.625\text{x}30 - .0866\text{x}18.75)}{3.82} = 4.49$$

$$Q_{R_1} = \frac{(.625\text{x}30 - .0482\text{x}56.25)}{7.64} = 2.24$$

Panel 2

$$-Q_B = (-.243)(.0443\text{x}37.5 - .625\text{x}30) = 4.16$$

$$-Q_C = \frac{(.625\text{x}30 - .0443\text{x}37.5)}{3.92} = 4.36$$

$$Q_{R_2} = \frac{(.625\text{x}30 - .0443\text{x}37.5)}{11.77} = 1.48$$

Panel 3

$$-Q_C = (-.25)(.0482\text{x}56.25 - .625\text{x}30) = 4.02$$

$$-Q_D = \frac{(.625\text{x}30 - .0482\text{x}56.25)}{(3.90)} = 4.12$$

$$Q_{R_3} = \frac{(.625\text{x}30 - .0482\text{x}56.25)}{15.60} = 1.03$$

Panel 4

$$-Q_D = (-.25)(0 - .375\text{x}30) = -2.81$$

$$-Q_E = \frac{(-.375\text{x}30 - 0)}{4} = -2.81$$

$$Q_{R_4} = \frac{(-.375\text{x}30 - 0)}{4\text{x}4} = -.70$$

Panel 5

$$-Q_E = -3.75$$

$$-Q_F = -3.75$$

$$Q_{R_5} = -0.938$$

Panel 6

$$-Q_F = -3.288$$

$$-Q_G = -3.204$$

$$Q_{R_6} = -0.82$$

Panel 7

$-Q_G = -3.496$

$-Q_H = -3.332$

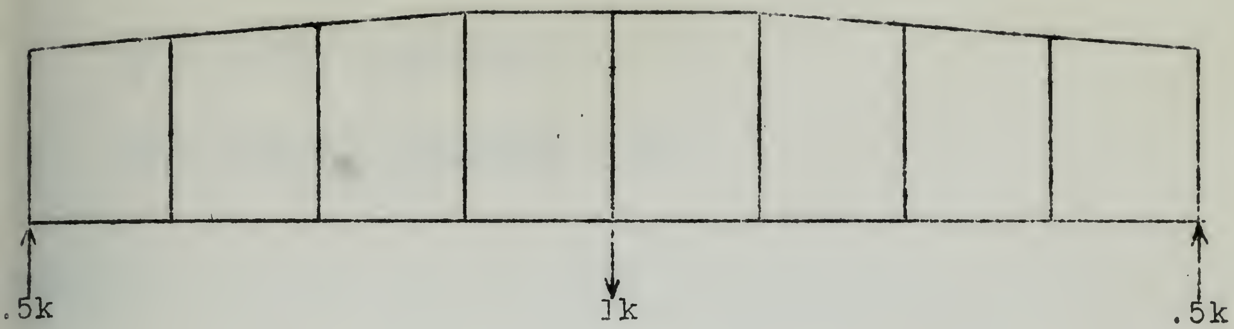
$Q_{R_7} = -1.164$

Panel 8

$-Q_H = -3.584$

$-Q_I = -2.908$

$Q_{R_8} = -1.792$



.0866	.0482	.0482	0	0	.0482	.0443	.0866
.0942	.0463	.0507	0	0	.0507	.0463	.0942
.5	.5	.5	.5	-.5	-.5	-.5	-.5
15	30	45	60	-60	-45	-30	-15

Panel 1

$$-Q_A = (-.222)(.0866x15 - .5x30) = 3.04$$

$$-Q_B = \frac{(.5x30 - .0866x15)}{3.82} = 3.59$$

$$Q_{R_1} = \frac{(.5x30 - .0866x15)}{7.64} = 1.79$$

Panel 2

$$-Q_B = (-.243)(.0443x30 - .5x30) = 3.32$$

$$-Q_C = \frac{(.5x30 - .0443x30)}{3.92} = 3.49$$

$$Q_{R_2} = \frac{(.5x30 - .0443x30)}{11.76} = 1.16$$

Panel 3

$$-Q_C = (-.25)(.0482x45 - .5x30) = 3.21$$

$$-Q_D = \frac{(.5x30 - .0482x45)}{3.90} = 3.30$$

$$Q_{R_3} = \frac{(.5x30 - .0482x45)}{15.60} = .82$$

Panel 4

$$-Q_D = (-.25)(0 - .5x30) = 3.75$$

$$-Q_E = \frac{(.5x30 - 0)}{4} = 3.75$$

$$Q_{R_4} = \frac{(.5x30 - 0)}{4x4} = .94$$

Panel 5

$$-Q_E = -2.31$$

$$-Q_F = -2.81$$

$$Q_{R_5} = -0.70$$

Panel 6

$$-Q_F = -2.47$$

$$-Q_G = -2.40$$

$$Q_{R_6} = -0.62$$

Panel 7

$$-Q_G = -2.62$$

$$-Q_H = -2.50$$

$$Q_{R_7} = -0.87$$

Panel 8

$$-Q_H = -2.18$$

$$-Q_I = -2.67$$

$$Q_{R_8} = -1.34$$

INFLUENCE LINES - JOINT CONSTANTS

LOAD AT B

Panel 1

$$\left[1.5\times4+2+\frac{(3-.0866)(.0942\times4-2)}{2(2-.0866)}\right]A+\left[1+\frac{(3-.17)(.0942\times4-2)}{2(2-.0866)}\right]B=-Q$$

$$6.77A-.25B=5.32$$

$$\left[2+1.5\times3-\frac{(3-.17)2}{2(2-.0866)}\right]B+\left[\frac{2}{3}-\frac{(3-.0866)2}{2(2-.0866)}\right]A=-Q_B$$

$$5.02B-.52A=6.27$$

Solving Simultaneously

$$A=0.82 \qquad B=1.33$$

$$R_1=\frac{(3-.0866)\ .82+(3-.17)1.33}{2(2-.0866)}+3.14=4.76$$

Panel 2

$$\left[1.5\times3+3+\frac{(3-.0443)(.0463\times3-3)}{2(2-.0443)}\right]B+\left[\frac{3}{2}+\frac{(3-.09)(.0463\times3-3)}{2(2-.0443)}\right]C$$
$$=-Q_B$$

$$5.34B-.62C=-1.16$$

$$\left[3+1.5\times2-\frac{(3-.0886)3}{2(2-.0443)}\right]C+\left[\frac{3}{2}-\frac{(3-.0443)3}{2(2-.0443)}\right]B=-Q_C$$

$$3.77C-.76B=-1.21$$

Solving Simultaneously

$$B=-.26 \qquad C=-.37$$

$$R_2=\frac{(3-.0443)(-.26)+(3-.09)(-.37)}{2(2-.0443)}-.40=-.87$$

Panel 3

$$\left[1.5x2+4-+\frac{(3-.0482)(.0507x2-4)}{2(2-.0482)}\right]C+\left[2+\frac{(3-.0964)(.0507x2-4)}{2(2-.0482)}\right]D=-Q_C$$

$$4.05\ C-.9\ D=-1.16$$

$$\left[4+1.5-\frac{(3-.0964)4}{2(2-.0482)}\right]D+\left[2-\frac{(3-.0482)4}{2(2-.0482)}\right]C=-Q_D$$

$$2.53\ D-1.02\ C=1.19$$

Solving Simultaneously

$$C=-.43$$
$$D=-.64$$

$$R_3=\frac{(3-.0482)(-.43)+(3-.0964)(-.64)}{2(2-.0482)}-.30=-1.10$$

Panel 4

$$\left[1.5x1+4+\frac{3(-4)}{4}\right]D+\left[2+\frac{3(-4)}{4}\right]E=-Q_D$$

$$2.5\ D-1\ E=-.94$$

$$\left[4+1.5x1-\frac{3x4}{4}\right]E+\left[\frac{4}{2}-\frac{3x4}{4}\right]D=-Q_E$$

$$2.5\ E-1\ D=-.94$$

Solving Simultaneously

$$D=-.63$$
$$E=-.63$$

$$R_4=\frac{3(-.63)+3(-.63)}{4}-.23=-1.18$$

Panel 5

$$\left[1.5 \times 1 + \frac{4}{4}\right] F - \frac{4}{4} E = -.94$$

$$\left[1.5 \times 1 + \frac{4}{4}\right] E - \frac{4}{4} F = -.94$$

$$E = -.63$$
$$F = -.63$$

$$R_5 = \frac{3}{4} (-.63 - .63) -.23 = -.94 -.23 = -1.17$$

Panel 6

$$\left[1.5 \times 2 + 4 + \frac{(3-.0482)(.0507 \times 2 - 4)}{2(2-.0482)}\right] G$$

$$+ \left[\frac{4}{2} + \frac{(3 - 2 \times .0482)(.0507 \times 2 - 4)}{2(2-.0482)}\right] F = -.80$$

$$4.06\ G - 0.89\ F = -.80$$

$$\left[4 + 1.5 \times 1 - \frac{(3-2\times.0482)4}{2(2-.0482)}\right] F + \left[\frac{4}{2} - \frac{(3-.0482)4}{2(2-.0482)}\right] G = -.82$$

$$2.53\ F - 1.02\ G = -.82$$

Solving Simultaneously

$$F = -.47$$
$$G = -.30$$

$$R_6 = -\frac{(3-.0482)\times.30 - (3-2\times.0482)\times.47}{2(2-.0482)} -.21 = -.78$$

Panel 7

$$\left[1.5 \times 3 + 3 + \frac{(3-.0443)(.0463\times3-3)}{2(2-.0443)}\right] H$$

$$+\left[\frac{3}{2} + \frac{(3-2\times.0443)(.0463\times3-3)}{2(2-.0443)}\right] G = -0.83$$

$$5.34\ H - .62\ G = -.83$$

$$\left[3 + 1.5 \times 2 - \frac{(3-2\times.0443)3}{2(2-.0443)}\right] G + \left[\frac{3}{2} - \frac{(3-.0433)3}{2(2-.0433)}\right] H = -.87$$

$$3.77\ G - .76\ H = -.87$$

Solving Simultaneously

$$G = -.27$$
$$H = -.19$$

$$R_7 = -\frac{(3-.0443)\times.19 + (3-2\times.0443)\times-.27}{2(2-.0443)} -0.29 = -.63$$

Panel 8

$$\left[1.5 \times 4 + 2 + \frac{(3-.0866)(.0942\times4-2)}{2(2-.0866)}\right] I + \left[\frac{2}{2} + \frac{(3-2\times.0866)(.0942\times4-2)}{2(2-.0866)}\right] H$$

$$= -.73$$

$$6.77\ I - .20\ H = -.73$$

$$\left[2 + 1.5 \times 3 - \frac{(3-2\times.0866)2}{2(2-.0866)}\right] H + \left[\frac{2}{2} - \frac{(3-.0866)2}{2(2-.0866)}\right] I$$

$$5.02\ H - .52\ I = -.49$$

Solving Simultaneously

$$H = -0.21$$
$$I = -0.11$$

$$R_8 = -\frac{(3-.0866)\times.11 - (3-2\times.0866)-.21}{2(2-.0861)} - 0.49 = .73$$

Influence Lines - Joint Constants

Load at C

Panel 1

$$6.77A - .2B = 4.56$$

$$-.52A + 5.02B = 5.38$$

Solving Simultaneously

$$A = .71$$

$$B = 1.14$$

$$R_1 = \frac{(3 - .0866).71 + (3 - .17)1.14}{2(2 - .0866)} + 2.69 = 4.07$$

Panel 2

$$5.34B - .62C = 4.98$$

$$3.77C - .76B = 5.23$$

Solving Simultaneously

$$B = 1.14$$

$$C = 1.62$$

$$R_2 = \frac{(3 - .0443)B + (3 - .0886)C}{2(2 - .0443)} + 1.76 = 3.80$$

Panel 3

$$4.05C - .9D = -2.23$$

$$2.53D - 1.02C = -1.19$$

Solving Simultaneously

$$C = -.72$$

$$D = -.76$$

$$R_3 = \frac{(3 - .0482)(-.72) + (3 - .0964)(-.76)}{2(2 - .0482)} -.59 = -1.70$$

Panel 4

$$2.5D - 1E = -1.87$$

$$2.5E - 1D = -1.87$$

Solving Simultaneously

$$D = -1.25$$

$$E = -1.25$$

$$R_4 = \frac{3(-1.25) + 3(-1.25)}{4} - .47 = -2.34$$

Panel 5

$E = -1.25$

$F = -1.25$

$R_5 = -2.34$

Panel 6

$F = -0.94$

$G = -0.60$

$R_6 = -1.56$

Panel 7

$G = -0.54$

$H = -0.37$

$R_7 = -1.27$

Panel 8

$H = -0.41$

$I = -0.23$

$R_8 = -1.45$

Influence Lines - Joint Constants

Load at D

Panel 1

$$6.77A - .2B = 3.81$$

$$-.52A + 5.02B = 4.49$$

Solving Simultaneously

$$A = .59$$

$$B = .96$$

$$R_1 = \frac{(3 - .0866).59 + (3 - .17).96}{2(2 - .0866)} + 2.24 = 3.40$$

Panel 2

$$5.34B - .62C = 4.16$$

$$3.77C - .76B = 4.36$$

Solving Simultaneously

$$B = .94$$

$$C = 1.34$$

$$R_2 = \frac{(3 - .0443)B + (3 - .0886)C}{2(2 - .0443)} + 1.48 = 3.18$$

Panel 3

$$4.05C - .9D = 4.02$$

$$2.53D - 1.02C = 4.12$$

Solving Simultaneously

$$C = 1.49$$

$$D = 2.23$$

$$R_3 = \frac{(3 - .0482)1.49 + (3 - .0964)2.23}{2(2 - .0482)} + 1.03 = 3.81$$

Panel 4

$$2.5D - 1E = -2.81$$

$$2.5E - 1D = -2.81$$

Solving Simultaneously

$$D = -1.87$$

$$E = -1.87$$

$$R_4 = \frac{3(-1.87) + 3(-1.87)}{4} - .70 = -3.51$$

Panel 5

$E = -1.88$

$F = -1.88$

$R_5 = -3.52$

Panel 6

$F = -1.41$

$G = -0.90$

$R_6 = -2.34$

Panel 7

$G = -0.81$

$H = -0.56$

$R_7 = -1.90$

Panel 8

$H = -0.62$

$I = -0.34$

$R_8 = -2.18$

Influence Lines - Joint Constants

Load at E

Panel 1

$$6.77A - .2B = 3.04$$

$$-.52A + 5.02B = 3.59$$

Solving Simultaneously

$$A = .47$$

$$B = .76$$

$$R_1 = \frac{(3 - .0866).47 + (3 - .17).76}{2(2 - .0866)} + 1.79 = 2.71$$

Panel 2

$$5.34B - .62C = 3.32$$

$$3.77C - .76B = 3.49$$

Solving Simultaneously

$$B = .75$$

$$C = 1.08$$

$$R_2 = \frac{(3 - .0443)B + (3 - .0866)C}{2(2 - .0433)} + 1.16 = 2.53$$

Panel 3

$$4.05C - .9D = 3.21$$

$$2.53D - 1.02C = 3.30$$

Solving Simultaneously

$$C = 1.19$$

$$D = 1.78$$

$$R_3 = \frac{(3 - .0482)1.19 + (3 - .0964)1.78}{2(2 - .0482)} + .82 = 3.04$$

Panel 4

$$2.5D - 1E = 3.75$$

$$2.5E - 1D = 3.75$$

Solving Simultaneously

$$D = 2.5$$

$$E = 2.5$$

$$R_4 = \frac{3(2.5) + 3(2.5)}{4} + .94 = 4.69$$

Panel 5

$E = -2.50$

$F = -2.50$

$R_5 = -4.69$

Panel 6

$F = -1.88$

$G = -1.20$

$R_6 = -3.12$

Panel 7

$G = -1.08$

$H = -.75$

$R_7 = 2.53$

Panel 8

$H = -.83$

$I = -.45$

$R_8 = -2.91$

Influence Lines - Moment Determination

Load at B

Panel 1

$$M_{AB} = 2(.82 + \frac{1.33}{2} - 4.76) = -6.56$$

$$M_{BA} = 2(1.33 + \frac{.82}{2} - 4.76) = -6.04$$

Panel 2

$$M_{BC} = 3(-.26 - \frac{.37}{2} + .87) = +1.29$$

$$M_{CB} = 3(-.37 - \frac{.26}{2} + .87) = +1.11$$

Panel 3

$$M_{CD} = 4(-.43 - \frac{.64}{2} + 1.10) = +1.40$$

$$M_{DC} = 4(-.64 - \frac{.43}{2} + 1.10) = +1.10$$

Panel 4

$$M_{DE} = 4(-.63 - \frac{.63}{2} + 1.18) = +.96$$

$$M_{ED} = 4(-.63 - \frac{.63}{2} + 1.18) = +.96$$

Panel 5

$$M_{EF} = 4(-.63 - \frac{.63}{2} + 1.17) = +0.94$$

$$M_{FE} = 4(-.63 - \frac{.63}{2} + 1.17) = +0.94$$

Panel 6

$$M_{FG} = 4(-.47 - \frac{.30}{2} + .78) = +0.64$$

$$M_{GF} = 4(-.30 - \frac{.47}{2} + .78) = +0.98$$

Panel 7

$$M_{GH} = 3(-.27 - \frac{.19}{2} + 0.63) = +0.81$$

$$M_{HG} = 3(-.19 - \frac{.27}{2} + 0.63) = +0.93$$

Panel 8

$$M_{HI} = 2(-.207 - \frac{.113}{2} + 0.727) = +0.93$$

$$M_{IH} = 2(-.113 - \frac{.207}{2} + 0.727) = +1.02$$

Influence Lines - Moment Determination

Load at C

Panel 1

$$M_{AB} = 2(.71 + \frac{1.14}{2} - 4.07) = -5.58$$

$$M_{BA} = 2(1.14 + \frac{.71}{2} - 4.07) = -5.16$$

Panel 2

$$M_{BC} = 3(1.14 + \frac{1.62}{2} - 3.80) = -5.55$$

$$M_{CB} = 3(1.62 + \frac{1.14}{2} - 3.80) = -4.83$$

Panel 3

$$M_{CD} = 4(-.72 - \frac{.76}{2} + 1.70) = +2.40$$

$$M_{DC} = 4(-.76 - \frac{.72}{2} + 1.70) = +2.32$$

Panel 4

$$M_{DE} = 4(-1.25 - \frac{1.25}{2} + 2.34) = +1.88$$

$$M_{ED} = 4(-1.25 - \frac{1.25}{2} + 2.34) = +1.88$$

Panel 5

$M_{EF} = 1.88$

$M_{FE} = 1.88$

Panel 6

$M_{FG} = 1.29$

$M_{GF} = 1.96$

Panel 7

$M_{GH} = 1.62$

$M_{HG} = 1.87$

Panel 8

$M_{HI} = 1.85$

$M_{IH} = 2.04$

Influence Lines - Moment Determination

Load at D

Panel 1

$$M_{AB} = 2(.59 + \frac{.96}{2} - 3.40) = -4.66$$

$$M_{BA} = 2(.96 + \frac{.59}{2} - 3.40) = -4.30$$

Panel 2

$$M_{BC} = 3(.94 + \frac{1.34}{2} - 3.18) = -4.71$$

$$M_{CB} = 3(1.34 + \frac{.94}{2} - 3.18) = -4.11$$

Panel 3

$$M_{CD} = 4(1.49 + \frac{2.23}{2} - 3.81) = -4.84$$

$$M_{DC} = 4(2.23 + \frac{1.49}{2} - 3.81) = -3.36$$

Panel 4

$$M_{DE} = 4(-1.87 - \frac{1.87}{2} + 3.51) = +2.84$$

$$M_{ED} = 4(-1.87 - \frac{1.87}{2} + 3.51) = +2.84$$

Panel 5

$$M_{EF} = 2.81$$

$$M_{FE} = 2.81$$

Panel 6

$$M_{FG} = 1.93$$

$$M_{GF} = 2.94$$

Panel 7

$$M_{GH} = 2.43$$

$$M_{HG} = 2.80$$

Panel 8

$$M_{HI} = 2.78$$

$$M_{IH} = 3.06$$

Influence Lines - Moment Determination

Load at E

Panel 1

$$M_{AB} = 2(.47 + \frac{.76}{2} - 2.79) = -3.88$$

$$M_{BA} = 2(.76 + \frac{.47}{2} - 2.79) = -3.60$$

Panel 2

$$M_{BC} = 3(.75 + \frac{1.08}{2} - 2.53) = -3.72$$

$$M_{CB} = 3(1.08 + \frac{.75}{2} - 2.53) = -3.24$$

Panel 3

$$M_{CD} = 4(1.19 + \frac{1.78}{2} - 3.04) = -3.84$$

$$M_{DC} = 4(1.78 + \frac{1.19}{2} - 3.04) = -2.68$$

Panel 4

$$M_{DE} = 4(2.5 + \frac{2.5}{2} - 4.69) = -3.76$$

$$M_{ED} = 4(2.5 + \frac{2.5}{2} - 4.69) = -3.76$$

Panel 5

$M_{EF} = 3.75$

$M_{FE} = 3.75$

Panel 6

$M_{FG} = 2.58$

$M_{GF} = 3.92$

Panel 7

$M_{GH} = 3.24$

$M_{HG} = 3.73$

Panel 8

$M_{HI} = 3.60$

$M_{IH} = 4.08$

First Moment Corrections - Load at B

Panel 1

$$6.77A - .20B = 0 \qquad A = -.01$$

$$-0.52A + 5.02B = -1.29 \qquad B = -.25$$

$$R_1 = \frac{-2.91x.01 - 2.83x.25}{3.83} = -.19$$

$$M_{AB} = 2(-.01 - \frac{.25}{2} + .19) = .12$$

$$M_{BA} = 2(-.25 - \frac{.01}{2} + .19) = -.12$$

Panel 2

$$5.34B - .63C = 6.04 \qquad B = 1.11$$

$$-0.77B + 3.77C = -1.40 \qquad C = -0.14$$

$$R_2 = \frac{2.96x1.11 - 2.91x.14}{3.91} = .74$$

$$M_{BC} = 2(1.11 - \frac{.14}{2} + 0.74) = .60$$

$$M_{CB} = 2(-.14 + \frac{1.11}{2} + 0.74) = -.64$$

Panel 3

$$4.06C - .89D = -1.11 \qquad C = -.39$$

$$-1.02C + 2.53D = -.96 \qquad D = -.54$$

$$R_3 = \frac{-2.95x.39 - 2.90x.54}{3.90} = -.70$$

$$M_{CD} = 3(-.39 - \frac{.54}{2} + .70) = .12$$

$$M_{DC} = 3(-.54 - \frac{.39}{2} + .70) = -.12$$

Panel 4

$$2.5\,D - E = -1.10$$
$$-0 + 2.5\,E = -.96$$
$$D = -.71$$
$$E = -.67$$

$$R_4 = \frac{3}{4}(-.67 - .71) = -1.03$$

$$M_{DE} = 4(-.71 - \frac{.67}{2} + 1.03) = -.08$$

$$M_{ED} = 4(-.67 - \frac{.71}{2} + 1.03) = .04$$

Panel 5

$$2.5\,E - F = -.64$$
$$-E + 2.5\,F = -.96$$
$$E = -.49$$
$$F = -.58$$

$$R_5 = \frac{3}{4}(-.58 - .49) = -.80$$

$$M_{EF} = 4(-.49 - \frac{.58}{2} + .80) = .08$$

$$M_{FE} = 4(-.58 - \frac{.49}{2} + .80) = -.12$$

Panel 6

$$4.06 - 0.89\,F = -.81$$
$$-1.026 + 2.53\,F = -.96$$
$$F = -.50$$
$$G = -.31$$

$$R_6 = -\frac{2.95 \times .31 - 2.90 \times .50}{3.90} = -.61$$

$$M_{FG} = 3(-.50 - \frac{.31}{2} + .61) = -.15$$

$$M_{GF} = 3(-.31 - \frac{.50}{2} + .61) = .15$$

Panel 7

$$5.34\ H - 0.63\ G = -.93$$
$$-0.77\ H + 3.77\ G = -.98$$
$$G = -.30$$
$$H = -.21$$

$$R_7 = \frac{-2.96 \times .21 - 2.91 \times .3}{3.91} = -.38$$

$$M_{GH} = 2(-.30 - \frac{.21}{2} + .38) = -.06$$

$$M_{HG} = 2(-.21 - \frac{.30}{2} + .38) = .06$$

Panel 8

$$5.02\ H - 0.52\ I = -.0.93$$
$$-0.20\ H + 6.77\ I = 0$$
$$H = -0.19$$
$$I = -0.01$$

$$R_8 = \frac{-2.91 \times .01 - 2.83 \times .19}{3.83} = -0.15$$

$$M_{HI} = 2(-.19 - \frac{.01}{2} + .15) = -.08$$

$$M_{IH} = 2(-.01 - \frac{.19}{2} + .15) = .08$$

SECOND MOMENT CORRECTIONS

Load at B

Panel 1

$$6.77\,A - 0.20\,B = 0$$
$$-0.52\,A + 5.02\,B = -.60$$

$$A = 0$$
$$B = -.12$$

$$R_1 = -\frac{2.83 \times .12}{3.83} = -.09$$

$$M_{AB} = 2(0 - \frac{.12}{2} + .09) = .06$$

$$M_{BA} = 2(-.12 + .09) = -.06$$

Panel 2

$$5.34\,B - 0.63\,C = -.12$$

$$-0.77\,B + 3.77\,C = .12$$

$$B = .03$$

$$C = .04$$

$$R_2 = \frac{-2.96 \times .03 - 2.91 \times .04}{3.91} = -.05$$

$$M_{BC} = 2(-.03 - \frac{.04}{2} + .05) = 0$$

$$M_{CB} = 2(-.04 - \frac{.03}{2} + .05) = -.01$$

Load at PP1

Panel		1		2		3		4	
Joint		A	B	B	C	C	D	D	E
	-Q	+5.32	+6.27	-1.16	-1.21	-1.16	-1.19	-0.94	-0.94
Initial Values	α	+1.31	+1.33	-0.26	-0.37	-0.43	-0.64	-0.63	-0.63
	R	+4.76		-0.87		-1.10		-1.18	
	M'	-6.56	-6.04	+1.29	+1.11	+1.40	+1.10	+0.96	+0.96
	-Q	+0.00	-1.29	+6.04	-1.40	-1.11	-0.96	-1.10	-0.96
First Incre-ment	α	-0.01	-0.25	+1.11	-0.14	-0.39	-0.54	-0.71	-0.67
	R	-0.19		+0.74		-0.70		-1.03	
	M'	+0.12	-0.12	+0.60	-0.64	+.12	- .12	- .08	+.04
	-Q	+0.00	-0.60	-0.12	-0.12	+0.64	-0.04	+0.12	+0.12
	α	+0.00	-0.12	-0.03	-0.04				
	R	-0.09		-0.05					
	M'	+0.06	-0.06	+0.00	-0.01	-	-	-	-
	M	-6.38	-6.22	+1.89	+0.46	+1.52	+0.98	+0.88	+1.00

	5		6		7		8	
	E	F	F	G	G	H	H	I
-Q	-0.94	-0.94	-0.82	-0.80	-0.87	-0.83	-0.90	-0.73
α	-0.63	-0.63	-0.47	-0.30	-0.27	-0.19	-0.21	-0.11
R	-1.18		-0.78		-0.63		-0.73	
M'	+0.96	+0.96	+0.64	+0.98	+0.81	+0.93	+0.93	+1.02
-Q	-0.96	-0.64	-0.96	-0.81	-0.98	-0.93	-0.93	+0.00
α	-0.49	-0.58	-0.50	-0.31	-0.30	-0.21	-0.19	-0.01
R	-0.80		-0.61		-0.38		-0.15	
M''	+0.08	-0.12	-0.15	+0.15	-0.06	+0.06	-0.08	+0.08
	+0.08	+0.15	+0.12	+0.06	-0.15	+0.08	-0.06	
	-	-	-	-	-	-	-	-
	+1.04	+0.84	+0.49	+1.13	+0.75	+0.99	+0.85	+1.10

First Moment Corrections

Load at C

Panel 1

$$6.77A - 0.20B = 0$$
$$-0.52A + 5.02B = 5.55$$
$$A = .33$$
$$B = 1.11$$

$$R_1 = \frac{2.91x.33 + 2.83x1.11}{3.33} = 1.07$$

$$M_{AB} = 2(.33 + \frac{1.11}{2} - 1.07) = -.36$$

$$M_{BA} = 2(1.11 + \frac{.33}{2} - 1.07) = .40$$

Panel 2

$$5.34B - 0.63C = 5.16$$
$$-0.77B + 3.77C = -2.40$$
$$B = .91$$
$$C = -.45$$

$$R_2 = \frac{2.96x.91 - 2.91x.45}{3.91} = .35$$

$$M_{BC} = 2(.91 - \frac{.45}{2} - .35) = 1.02$$

$$M_{CB} = 2(-.45 + \frac{.91}{2} - .35) = -1.05$$

Panel 3

$$4.06C - 0.89D = 4.83$$
$$-1.02C + 2.53D = -1.88$$
$$C = 1.13$$
$$D = -0.29$$

$$R_3 = \frac{2.95x1.13 - 2.90x.29}{3.90} = .64$$

$$M_{CD} = 3(1.13 - \frac{.29}{2} - .64) = 1.08$$

$$M_{DC} = 3(-.29 + \frac{1.13}{2} - .64) = -1.08$$

Panel 4

$$2.5D - E = -2.32$$
$$-D + 2.5E = -1.88$$
$$D = -1.34$$
$$E = -1.46$$

$$R_4 = \frac{3}{4}(-1.34 - 1.46) = -2.10$$

$$M_{DE} = 4(-1.34 - \frac{1.46}{2} + 2.10) = .12$$

$$M_{ED} = 4(-1.46 - \frac{1.34}{2} + 2.10) = -.12$$

Panel 5

$$2.5E - F = -1.88$$
$$-E + 2.5F = -1.29$$
$$E = -1.14$$
$$F = -.97$$

$$R_5 = \frac{3}{4}(-1.14 - .97) = -1.58$$

$$M_{EF} = 4(-1.14 - \frac{.97}{2} + 1.58) = -.16$$

$$M_{FE} = 4(-.97 - \frac{1.14}{2} + 1.58) = .16$$

Panel 6

$$2.53F - 1.02G = -1.88$$
$$-0.89F + 4.06G = -1.62$$
$$F = -.99$$
$$G = -.62$$

$$R_6 = \frac{-2.95x.62 - 2.90x.60}{3.91} = -.77$$

$$M_{FG} = 3(-.99 - \frac{.62}{2} + .77) = -.40$$

$$M_{GF} = 3(-.62 - \frac{.99}{2} + .77) = .32$$

Panel 7

$$3.77G - 0.77H = -1.96$$

$$-0.63G + 5.34H = -1.85$$

$$G = -.60$$

$$H = -.42$$

$$R_7 = \frac{-2.91x.60 - 2.96x.42}{3.91} = -.77$$

$$M_{GH} = 2(-.60 - \frac{.42}{2} + .77) = -.12$$

$$M_{HG} = 2(-.42 - \frac{.60}{2} + .77) = .15$$

Panel 8

$$5.02H - 0.52I = -1.87$$

$$-0.20H + 6.72I = 0$$

$$H = -.37$$

$$I = -.01$$

$$R_8 = \frac{-2.83x.37 - 2.91x.01}{3.83} = -.28$$

$$M_{HI} = 2(-.37 - \frac{.01}{2} + .28) = -.18$$

$$M_{IH} = 2(-.01 - \frac{.37}{2} + .28) = .18$$

Second Moment Corrections - Load at C

Panel 1

$$6.77A - 0.20B = 0$$
$$-0.52A + 5.02B = -1.02$$
$$A = -.01$$
$$B = -.20$$

$$R_1 = \frac{-2.91x.01 - 2.83x.20}{3.83} = -.16$$

$$M_{AB} = 2(-.01 - \frac{.20}{2} + .16) = .10$$

$$M_{BA} = 2(-.20 - \frac{.01}{2} + .16) = -.10$$

Panel 2

$$5.34B - 0.63C = -.40$$
$$-0.77B + 3.77C = -1.08$$
$$B = -.11$$
$$C = -.28$$

$$R_2 = \frac{-2.96x.11 - 2.91x.28}{3.91} = -.30$$

$$M_{BC} = 2(-.11 - \frac{.28}{2} + .30) = .15$$

$$M_{CB} = 2(-.28 - \frac{.11}{2} + .30) = -.09$$

Panel 3

$$4.06C - 0.89D = 1.05$$
$$-1.02C + 2.53D = -.12$$
$$C = .27$$
$$D = .06$$

$$R_3 = \frac{2.95x.27 + 2.90x.06}{3.90} = .24$$

$$M_{CD} = 3(.27 + \frac{.06}{2} - .24) = .24$$

$$M_{DC} = 3(.06 + \frac{.27}{2} - .24) = -.16$$

Panel 4

$$2.5D - E = 1.08$$
$$-D + 2.5E = .16$$
$$D = .74$$
$$E = .36$$

$$R_5 = \frac{3}{4}(.74 + .36) = .82$$

$$M_{DE} = 4(.74 + \frac{.36}{2} - .82) = .40$$

$$M_{ED} = 4(.36 + \frac{.74}{2} - .82) = -.36$$

Panel 5

$$2.5E - F = .12$$
$$-E + 2.5F = .40$$
$$E = .13$$
$$F = .21$$

$$R_5 = \frac{3}{4}(.13 + .21) = .25$$

$$M_{EF} = 4(.13 + \frac{.21}{2} - .25) = -.08$$

$$M_{FE} = 4(.21 + \frac{.13}{2} - .25) = .08$$

Panel 6

$$2.53F - 1.02G = -.16$$
$$-0.89F + 4.06G = .12$$
$$F = -.06$$
$$G = .02$$

$$R_6 = \frac{-2.90x.06 + 2.95x.02}{3.90} = -.03$$

$$M_{FG} = 3(-.06 + \frac{.02}{2} + .03) = -.06$$

$$M_{GF} = 3(.02 - \frac{.06}{2} + .03) = .06$$

Panel 7

$$3.77G - 0.77H = -.32$$

$$-0.63G + 5.34H = .18$$

$$G = -.08$$

$$H = .02$$

$$R_7 = \frac{2.96x.02 - 2.91x.08}{3.91} = -.04$$

$$M_{GH} = 2(-.08 + \frac{.02}{2} + .04) = -.06$$

$$M_{HG} = 2(.02 - \frac{.08}{2} + .04) = .04$$

Panel 8

$$5.02H - 0.52I = -.15$$

$$-0.20H + 6.77I = 0$$

$$H = -.03$$

$$I = 0$$

$$R_8 = \frac{-2.83x.03}{3.83} = -.02$$

$$M_{HI} = 2(-.03 + .02) = -.02$$

$$M_{IH} = 2(\frac{-.03}{2} + .02) = .02$$

Load at PP2

Panel	1		2		3		4	
Joint	A	B	B	C	C	D	D	E
-Q	4.56	5.38	4.98	5.23	-2.33	-2.38	-1.87	-1.87
α	0.71	1.14	1.14	1.62	-0.72	-0.76	-1.25	-1.25
R	4.07		3.80		-1.70		-2.34	
M'	-5.58	-5.16	-5.55	-4.83	2.40	2.32	1.88	1.88
-Q	0.00	5.55	5.16	-2.40	4.83	-1.88	-2.32	-1.88
α	0.33	1.11	0.91	-0.45	1.13	-0.29	-1.34	-1.46
R	1.07		0.35		0.64		-2.10	
M"	-0.36	0.40	1.02	-1.05	1.08	-1.08	0.12	-0.12
-Q	0.00	-1.02	-0.40	-1.08	1.05	-0.12	1.08	0.16
α	-0.01	-0.20	-0.11	-0.28	0.27	0.06	0.74	0.36
R	-0.16		-0.30		0.24		0.82	
M'''	0.10	-0.10	0.15	-0.09	0.24	-0.16	0.40	-0.36
M	-5.84	-4.81	-4.38	-5.97	3.72	1.08	2.40	1.40

5		6		7		8	
E	F	F	G	G	H	H	I
-1.87	-1.87	-1.64	-1.60	-1.75	-1.67	-1.79	-1.45
-1.25	-1.25	-0.94	-0.60	-0.54	-0.37	-0.41	-0.23
-2.34		-1.56		-1.27		-1.45	
1.88	1.88	1.29	1.96	1.62	1.87	1.85	2.04
-1.88	-1.29	-1.88	-1.62	-1.96	-1.85	-1.87	0.00
-1.14	-0.97	-0.99	-0.62	-0.60	-0.42	-0.37	-0.01
-1.58		-1.20		-0.77		-0.28	
-0.16	0.16	-0.40	0.32	-0.12	0.15	-0.18	0.18
0.12	0.40	-0.16	0.12	-0.32	0.18	-0.15	0.00
0.13	0.21	-0.06	0.02	-0.08	0.02	-0.03	0.00
0.25		-0.03		-0.04		-0.02	
-0.08	0.08	-0.06	0.06	-0.06	0.04	-0.02	0.02
1.64	2.12	0.83	2.34	1.38	2.06	1.65	2.24

Influence Lines - First Correction

Load at Panel Pt 3 (= D)

Panel 1

$$6.77A - .2B = 0 \qquad A = .03$$

$$-.52A + 5.02B = 4.71 \qquad B = .94$$

$$R_1 = \frac{(3 - .0866).03 + (3 - .1732).94}{2(2 - .0866)} = .72$$

$$M_{AB} = 2(.03 + \frac{.94}{2} - .72) = -.44$$

$$M_{BA} = 2(.94 + \frac{.03}{2} - .72) = .46$$

Panel 2

$$5.34B - .62C = 4.30 \qquad B = .98$$

$$-.76B + 3.77C = 4.84 \qquad C = 1.48$$

$$R_2 = \frac{(3 - .0443).98 + (3 - .0886)1.48}{2(2 - .0443)} = 1.84$$

$$M_{BC} = 3(.98 + \frac{1.48}{2} - 1.84) = -.36$$

$$M_{CB} = 3(1.48 + \frac{.98}{2} - 1.84) = .39$$

Panel 3

$$4.05C - .9D = 4.11 \qquad C = .84$$

$$-1.02C + 2.53D = -2.84 \qquad D = -.78$$

$$R_3 = \frac{(3 - .0482).84 + (3 - .0964)(-.78)}{2(2 - .0482)} = .06$$

$$M_{CD} = 4(.84 - \frac{.78}{2} - .06) = 1.56$$

$$M_{DC} = 4(-.78 + \frac{.84}{2} - .06) = -1.68$$

Panel 4

$$2.5D - 1E = 3.36$$
$$-1D + 2.5E = -2.81$$
$$D = 1.07$$
$$E = -.70$$

$$R = \frac{3}{4}(1.07 - .70) = .28$$

$$M_{DE} = 4(1.07 - \frac{.70}{2} - .28) = 1.76$$

$$M_{ED} = 4(-.70 + \frac{1.07}{2} - .28) = -1.80$$

Panel 5

$$2.5F - 1E = -2.84$$
$$-1F + 2.5E = -1.93$$
$$E = -1.46$$
$$F = -1.72$$

$$R = \frac{3}{4}(-1.46 - 1.72) = -2.38$$

$$M_{FE} = 4(-1.72 - \frac{1.46}{2} + 2.38) = -.28$$

$$M_{EF} = 4(-1.46 - \frac{1.72}{2} + 2.38) = .24$$

Panel 6

$$4.05G - 0.9F = -2.43$$
$$-1.02G + 2.53F = -2.81$$
$$G = -.93$$
$$F = -1.48$$

$$R = \frac{-(3 - .0482).93 - (3 - .0964)1.48}{2(2 - .0482)} = -1.80$$

$$M_{FG} = 4(-1.48 - \frac{.93}{2} + 1.80) = -.56$$

$$M_{GF} = 4(-.93 - \frac{1.48}{2} + 1.80) = .52$$

Panel 7

$$5.34\ H - .62\ G = -2.78$$

$$-.76\ H + 3.77\ G = -2.94$$

$$G = -.91$$

$$H = -.63$$

$$R = -\frac{(3-.0443)\ .63 - (3-.0886)\ .91}{2(2-.0443)} = -1.15$$

$$M_{GH} = 3\left(-.91 - \frac{.63}{2} + 1.15\right) = -.21$$

$$M_{HG} = 3\left(-.63 - \frac{.91}{2} + 1.15\right) = .21$$

Panel 8

$$6.77\ I - .2\ H = 0$$

$$-.52\ I + 5.02\ H = -2.80$$

$$H = -.56$$

$$I = -.02$$

$$R = -\frac{(3-.0866).02 - (3-.1732)\ .56}{2(2-.0866)} = -.43$$

$$M_{HI} = 2\left(-.56 - \frac{.02}{2} + .43\right) = -.28$$

$$M_{IH} = 2\left(-.02 - \frac{.56}{2} + .43\right) = .26$$

Influence Lines - Second Correction

Load @ PP3 = D

Panel 1

$$6.77\ A - .2\ B = 0$$

$$-.52\ A + 5.02\ B = +.44$$

$$A = .003$$
$$B = .090$$

$$R_1 = \frac{(3-.0866).003 + (3-1.732).09}{2(2-.0866)} = .094$$

$$M_{AB} = 2(.003 + \frac{.090}{2} - .094) = -.09$$

$$M_{BA} = 2(.090 + .003 - .094) = -.01$$

Panel 2

$$5.34\ B - .62\ C = -.46$$

$$-.76\ B + 3.77\ C = 1.56$$

$$B = -.04$$
$$C = .41$$

$$R_2 = \frac{(3-.0443)\ -.04 + (3-.0886)(+.41)}{2(2-.0443)} = .28$$

$$M_{BC} = 3(-.04 + \frac{.41}{2} - .28) = -.36$$

$$M_{CB} = 3(+.41 - \frac{.04}{2} - .28) = .33$$

Panel 3

$$4.05\ C - 0.9\ D = -.39$$

$$-1.02\ C + 2.53\ D = -1.76$$

$$C = -.27$$
$$D = -.81$$

$$R_3 = \frac{(3-.0482)(-.27) + (3-.0964)(-.81)}{2(2-.0482)} = -.80$$

$$M_{CD} = 4(-.27 - \frac{.81}{2} + .80) = .52$$

$$M_{DC} = 4(-.81 - \frac{.27}{2} + .80) = -.44$$

Panel 4

$$2.5\,D - 1E = 1.68$$

$$-1.0\,D + 2.5\,E = -.24$$

$$D = .75$$
$$E = .21$$

$$R_4 = \frac{3}{4}(.75 + .21) = .72$$

$$M_{DE} = 4(.75 + \frac{.21}{2} - .72) = .52$$

$$M_{ED} = 4(.21 + \frac{.75}{2} - .72) = -.56$$

Panel 5

$$-1\,F + 2.5\,E = 1.80$$

$$2.5\,F - 1.0\,E = 1.56$$

$$E = .96$$
$$F = .61$$

$$R_5 = \frac{3}{4}(.96 + .61) = 1.18$$

$$M_{EF} = 4(.96 + \frac{.61}{2} - 1.18) = .32$$

$$M_{FE} = 4(.61 + \frac{.96}{2} - 1.18) = -.40$$

Panel 6

$$-1.02\,G + 2.53\,F = .28$$

$$4.05\,G - 0.9\,F = .21$$

$$G = .08$$
$$F = .14$$

$$R_6 = \frac{(3-.0482).08 + (3-.0964).14}{2(2 - .0482)} = .16$$

$$M_{FG} = 4(.14 + \frac{.08}{2} - .16) = .08$$

$$M_{GF} = 4(.08 + \frac{.14}{2} - .16) = -.04$$

Panel 7

$$-.76\,H + 3.77\,G = -.52$$

$$5.34\,H - .62\,G = .28$$

$$H = .04$$

$$G = -.13$$

$$R_7 = \frac{(3-.0443).04 - (3-.0886).13}{2(2-.0443)} = -.07$$

$$M_{GH} = 3\left(-.13 + \frac{.04}{2} + .07\right) = -.12$$

$$M_{HG} = 3\left(.04 - \frac{.13}{2} + .07\right) = .15$$

Panel 8

$$-.52\,I + 5.02\,H = -.21$$

$$6.77\,I - 0.20\,H = 0$$

$$I = 0$$

$$H = -.04$$

$$R_8 = -\frac{(3-.1732).04}{2(2-.0866)} = -.03$$

$$M_{HI} = 2(-.04 + .03) = -.02$$

$$M_{IH} = 2\left(-\frac{.04}{2} + .03\right) = .02$$

Load At PP3 = D

anel oint	1 A	 B	2 B	 C	3 C	 D	4 D	 E
-Q	3.81	4.49	4.16	4.36	4.02	4.12	-2.81	-2.81
φ	.59	.96	.94	1.34	1.49	2.23	-1.87	-1.87
R	3.40		3.18		3.81		-3.51	
M'	-4.66	-4.30	-4.71	- 4.11	-4.84	-3.36	2.84	2.84
-Q	0	4.71	4.30	4.84	4.11	-2.82	3.36	- 2.81
φ	.03	.94	.98	1.48	.84	-.78	1.07	-.70
R	.72		1.84		.06		.28	
M"	-.44	.46	-.36	.39	1.56	-1.68	1.76	-1.80
-Q	0	.44	-.46	1.56	-.39	-1.76	1.68	-.24
φ	.003	.090	-.04	.41	-.27	-.81	.75	.21
R	.094		.28		-.80		.72	
M'''	-.09	-.01	-.36	.33	.52	-.44	.52	-.56
Σ M	-5.19	-3.85	-5.43	-3.39	-2.76	-5.48	5.12	.48

cnt.)

Panel Point	5 E	5 F	6 F	6 G	7 G	7 H	8 H	8 I
-Q	-2.81	-2.81	-2.47	-2.40	-2.62	-2.50	-2.67	-2.18
g	-1.87	-1.87	-1.41	-0.90	-0.81	-0.56	-0.62	-0.34
R	-3.52		-2.34		-1.90		-2.18	
M'	2.81	2.81	1.93	2.94	2.43	2.80	2.78	3.06
-Q	-1.93	-2.84	-2.43	-2.81	-2.78	-2.94	-2.80	0
g	-1.46	-1.72	-1.48	-.93	-.91	-.63	-.56	-.02
R	-2.38		-1.80		-1.15		-.43	
M"	.24	-.28	-.56	.52	-.21	.21	-.28	.26
-Q	1.80	.56	.28	.21	.52	.28	-.21	0
g	.61	.96	.14	.08	-.13	.04	-.04	0
M"'	1.18		.16		-.07		-.03	
ΣM	3.37	2.13	1.45	3.32	2.10	3.16	2.48	3.34

Influence Lines - First Corrections
Load at E

Panels 1 & 8

$$6.77A - 0.20B = 0 \qquad A = .02$$
$$-0.52A + 5.02B = 3.72 \qquad B = .72$$

$$R_1 = \frac{2.914x.02 + 2.828x.72}{3.828} = .55$$

$$M_{AB} = 2(.02 + \frac{.72}{2} - .55) = -.34$$

$$M_{BA} = 2(.72 + \frac{.02}{2} - .55) = .36$$

Panels 2 & 7

$$5.34B - 0.63C = 3.60 \qquad B = .81$$
$$-0.77B + 3.77C = 3.84 \qquad C = 1.18$$

$$R_2 = \frac{2.96x.81 + 2.91x1.18}{3.912} = 1.49$$

$$M_{BC} = 3(.81 + \frac{1.18}{2} - 1.49) = -.27$$

$$M_{CB} = 3(1.18 + \frac{.81}{2} - 1.49) = .27$$

Panels 3 & 6

$$4.06C - 0.89D = 3.24 \qquad C = 1.23$$
$$-1.02C + 2.53D = 3.76 \qquad D = 1.99$$

$$R_3 = \frac{2.95x1.23 + 2.90x1.99}{3.904} = 2.40$$

$$M_{CD} = 4(1.23 + \frac{1.99}{2} - 2.40) = -.72$$

$$M_{DC} = 4(1.99 + \frac{1.23}{2} - 2.40) = .80$$

Panels 4 & 5

$$2.5E - 1.0D = 2.68$$

$$-1.0E + 2.5D = -3.75$$

$$R_4 = \frac{3}{4}(-1.28 + .56) = -.54$$

$$M_{DE} = 4(-1.28 + \frac{.56}{2} + .54) = -1.84$$

$$M_{ED} = 4(.56 - \frac{1.28}{2} + .54) = 1.84$$

Influence Lines - Second Correction

Load at E

Panels 1 & 8

$$6.77A - 0.20B = 0 \qquad A = 0$$
$$-0.52A + 5.02B = .27 \qquad B = .05$$

$$R_4 = .04$$

$$R_1 = \frac{2.914 \times 0 + 2.828 \times .05}{3.828}$$

$$M_{AB} = 2(0 + \frac{.05}{2} - .04) = -.04$$

$$M_{BA} = 2(.05 + \frac{0}{2} - .04) = .02$$

Panels 2 & 7

$$5.34B - 0.63C = -.36 \qquad B = -.05$$
$$-0.77B + 3.77C = .72 \qquad C = .18$$

$$R_2 = \frac{-2.96 \times .05 + 2.91 \times .18}{3.912} \qquad R_4 = .10$$

$$M_{BC} = 3(-.05 + \frac{.18}{2} - .10) = -.18$$

$$M_{CB} = 3(.18 - \frac{.05}{2} - .10) = .18$$

Panels 3 & 6

$$4.06C - 0.89D = -.27 \qquad C = -.24$$
$$-1.02C + 2.53D = 1.84 \qquad D = -.86$$

$$R_3 = \frac{2.95(-.25) + 2.90(-.82)}{3.904} \qquad R_3 = -.80$$

$$M_{CD} = 4(-.25 - \frac{.82}{2} + .80) = .56$$

$$M_{DC} = 4(-.82 - \frac{.25}{2} + .80) = -.56$$

Panels 4 & 5

$$2.5E - 1.0D = -.80 \qquad D = -.02$$
$$-1.0E + 2.5D = 1.84 \qquad E = .73$$

$$R_4 = \frac{3}{4}(-.02 + .73) \qquad R_4 = .53$$

$$M_{DE} = 4(-.02 + \frac{.73}{2} + .53) = -.76$$

$$M_{ED} = 4(.73 - \frac{.02}{2} - .53) = .76$$

Load at Panel Pt 4 = E

Panel	1		2		3		4	
Joint	A	B	B	C	C	D	D	E
-Q	3.04	3.59	3.32	3.49	3.21	3.30	3.75	3.75
α	.47	.76	.75	1.08	1.19	1.78	2.50	2.50
R	2.79		2.53		3.04		4.69	
M'	-3.88	-3.60	-3.72	-3.24	-3.84	-2.68	-3.76	-3.76
-Q	0	3.72	3.60	3.84	3.24	3.76	2.68	-3.75
α	.02	.72	.81	1.18	1.23	1.99	-1.28	.56
R	.55		1.49		2.40		- .54	
M"	- .34	.36	- .27	.27	- .72	.80	1.84	-1.84
-Q	0	.27	- .36	.72	-.27	-1.84	- .80	1.84
α	0	.05	- .05	.18	- .25	- .82	- .02	.73
R	.04		.10		- .80		.53	
M'	- .04	.02	- .18	.18	.56	- .56	- .76	.76
M'''	-4.26	-3.32	-4.17	-2.79	-4.00	-2.44	-2.68	-4.84

Panel	5		6		7		8	
Joint	E	F	F	G	G	H	H	I
-Q	-3.75	-3.75	-3.29	-3.20	-3.50	-3.33	-3.58	-2.91
α	-2.50	-2.50	-1.87	-1.20	-1.08	-0.75	-0.83	-0.45
R	-4.69		-3.12		-2.53		-2.91	
M'	3.75	3.75	2.58	3.92	3.24	3.73	3.60	4.08
-Q	3.76	-2.58	-3.75	-3.24	-3.92	-3.60	-3.72	0
α	1.30	- .51	-1.98	-1.23	-1.20	- .81	- .72	- .02
R	.59		-2.40		-1.51		- .55	
M'	1.84	1.80	- .76	.72	- .27	.30	- .36	.34
-Q	-1.84	.76	1.80	.27	- .72	.36	-.30	0
α	- .73	.02	.82	.25	- .18	.05	- .05	0
R	- .53		.80		- .10		- .04	
M''	- .76	.76	.56	- .56	- .18	.18	- .02	.04
M'''	4.83	2.71	2.38	4.08	2.79	4.18	3.22	4.26

Preliminary Moment Computations - Web Members

Member AA'

Moment Dh		=	3144 fk
hh E-60		=	2865
Impact		=	615
	Total		3480
hh H-15-S-12 44		=	368
Conc		=	86
Impact		=	50
	Total		504
Sidewalk hh		=	220

Design Moment = 7362 fk

Member BB'

Dh		=	5170
hh E-60		=	4410
Impact		=	950
	Total		5360
hh H15-S-12 44		=	605
Conc.		=	125
Impact		=	83
	Total		813
Sidewalk hh		=	362

Design Moment = 11,745 fk

Member CC'

Dh		=	3000
hh E-60		=	2630
Impact		=	830
	Total		3460
hh H15-S-12-44		=	350
Conc.		=	92
Impact		=	67
	Total		509
Sidewalk hh		=	256

Design Moment = 7243 fk

Member DD'

DL		=	1600
LL E-60		=	1480
Impact		=	520
	Total		2000
LL H15-S12-44		=	182
Conc.		=	69
Impact		=	37
	Total		288
Sidewalk		=	144

Design Moment = 4046 fk

Member EE'

DL		=	945
LL E-60		=	910
Impact		=	441
	Total		1351
LL H15-S12-44		=	110
Conc.		=	52
Impact		=	26
	Total		188
Sidewalk		=	97

Design Moment = 2593 fk

Preliminary Moment Computations - Chord Members

Member AB

DL	=	3440
LL E-60	=	3020
Impact	=	695
Total		3715
LL H15-S12-44	=	403
Conc.	=	87
Impact	=	73
Total		563
Sidewalk hh	=	240

Design Moment = 7958 fk

Member BC

DL	=	2260
LL E-60	=	2040
Impact	=	520
Total		2560
LL H15-S12-44	=	264
Conc.	=	50
Impact	=	52
Total		366
Sidewalk hh	=	173

Design Moment = 5360 fk

Member CD

DL	=	1432
LL E-60	=	1330
Impact	=	383
Total		1713
LL H15-S12-44	=	168
Conc.	=	73
Impact	=	44
Total		285
Sidewalk	=	118

Design Moment = 3548 fk

Member DE

DL	=	1480
LL E-60	=	1400
Impact	=	490
Total		1890
LL H15-S12-44	=	173
Conc.	=	66
Impact	=	49
Total		288
Sidewalk	=	133

Design Moment = 3790 fk

Determination of K values for second computations

$$K = \frac{I}{L} = \frac{Mc}{fL} \qquad \text{Assuming } C = 15''$$

$$K = \frac{M \times 15 \times 12}{20 \times L \times 12} \quad \text{or} \quad K = .75\frac{M}{L}$$

Member	M	L	.75M/L = K
AA'	7362	35	160
BB'	11,745	38	232
CC'	7,243	40	136
DD'	4,064	41	74
EE'	2,593	41	47
AB	7,958	30	200
BC	5,360	30	134
CD	3,548	30	90
DE	3,790	30	95

Influence Line Computations - Second Set
Load at B

Panel 1

$$-Q_A = \frac{(.0942\text{x}160 - 200)(.0866\text{x}26.25 - .875\text{x}30)}{2(2 - .0866)200} = 8.$$

$$-Q_B = \frac{(.875\text{x}30 - .0866\text{x}26.25)}{2(2 - .0866)} = 6.28$$

$$Q_{R_1} = \frac{(.875\text{x}30 - .0866\text{x}26.25)}{2(2 - .0866)200} = 0.31$$

Panel 2

$$-Q_B = \frac{(.0463\text{x}232 - 134)(.0443\text{x}22.5 + .125\text{x}30)}{2(2 - .0443)134} = -1.11$$

$$-Q_C = \frac{(-.125\text{x}30 - .0443\text{x}22.5)}{2(2 - .0443)} = -1.21$$

$$Q_{R_2} = \frac{(-.125\text{x}30 - .0443\text{x}22.5)}{2(2 - .0443)134} = -.009$$

Panel 3

$$-Q_C = \frac{(.0507\text{x}136 - 90)(.0482\text{x}18.75 + .125\text{x}30)}{2(2 - .0482)90} = -1.10$$

$$-Q_D = \frac{(-.125\text{x}30 - .0482\text{x}18.75)}{2(2 - .0482)} = -1.19$$

$$Q_{R_3} = \frac{(-.125\text{x}30 - .0482\text{x}18.75)}{2(2 - .0482)90} = -0.13$$

Panel 4

$$-Q_D = \frac{-95(.125\text{x}30)}{4\text{x}95} = -.94$$

$$-Q_E = \frac{(-.125\text{x}30)}{4} = -.94$$

$$Q_{R_4} = \frac{(-.125\text{x}30)}{4\text{x}95} = -.01$$

Panel 5

$$-Q_E = \frac{-1.25x30}{4} = -.94$$

$$-Q_F = \frac{-1.25x30}{4} = -.94$$

$$Q_{E_5} = \frac{-1.25x30}{4x95} = -.0099$$

Panel 6

$$-Q_G = \frac{(.0507x136 - 90)(-.0482x11.25 + .125x30)}{2(2 - .0482)90} = -.77$$

$$-Q_F = \frac{(-1.25x30 + .0482x11.25)}{2(2 - .0482} = -.82$$

$$Q_{R6} = \frac{(-.125x30 + .0482x11.25)}{2(2 - .0482)90} = -.0091$$

Panel 7

$$-Q_H = \frac{(.0463x232 - 134)(-.0443x7.5 + .125x30)}{2(2 - .0443)134} = -.81$$

$$-Q_G = \frac{(-.125x30 + .0443x7.5)}{2(2 - .0443)} = -.87$$

$$Q_{R7} = \frac{(-.125x30 + .0443x7.5)}{2(2 - .0443)134} = -.0065$$

Panel 8

$$-Q_I = \frac{(.0942x160 - 200)(-.0866x3.75 + .125x30)}{2(2 - .0866)200} = -.83$$

$$-Q_H = \frac{(-.125x30 + .0866x3.75)}{2(2 - .0866)} = -.90$$

$$Q_{R8} = \frac{(-.125x30 + .0866x3.75)}{2(2 - .0866)200} = -.0045$$

Load at C

Panel 1

$$-Q_A = \frac{(.0942\times160 - 200)(.0866\times22.5 - .75\times30)}{2(2 - .0866)200} = 4.98$$

$$-Q_B = \frac{(.75\times30 - .0866\times22.5)}{2(2 - .0866)} = 5.38$$

$$Q_{R_1} = \frac{(.75\times30 - .0866\times22.5)}{2(2 - .0866)200} = 0.27$$

Panel 2

$$-Q_B = \frac{(.0463\times232 - 134)(.0443\times45 - .75\times30)}{2(2 - .0443)134} = 4.82$$

$$-Q_C = \frac{(.75\times30 - .0443\times45)}{2(2 - .0443)} = 5.24$$

$$Q_{R_2} = \frac{(.75\times30 - .0443\times45)}{2(2 - .0443)134} = 0.39$$

Panel 3

$$-Q_C = \frac{(.0507\times136 - 90)(.0482\times37.5 + .25\times30)}{2(2 - .0482)90} = -2.20$$

$$-Q_D = \frac{(-.25\times30 - .0482\times37.5)}{2(2 - .0482)} = -2.39$$

$$Q_{R_3} = \frac{-.25\times30 - .0482\times37.5}{2(2 - .0482)90} = -.027$$

Panel 4

$$-Q_D = \frac{(-95)(.25\times30)}{4\times95} = -1.87$$

$$-Q_E = \frac{(-.25\times30)}{4} = -1.87$$

$$Q_{R_4} = \frac{-.25\times30}{4\times95} = -.020$$

Panel 5

$-Q_E = -1.88$

$-Q_F = -1.88$

$Q_{R5} = -.020$

Panel 6

$-Q_F = -1.64$

$-Q_G = -1.52$

$Q_{R6} = -.018$

Panel 7

$-Q_G = -1.74$

$-Q_H = -1.62$

$Q_{R7} = -.013$

Panel 8

$-Q_H = -1.80$

$-Q_I = -1.66$

$Q_{R8} = -.0090$

Load at D

Panel 1

$$-Q_A = \frac{(.0942\text{x}160 - 200)(.0866\text{x}18.75 - .625\text{x}30)}{2(2 - .0866)200} = 4.\text{[illegible]}5$$

$$-Q_B = \frac{.625\text{x}30 - .0866 \text{ x } 18.75}{2(2 - .0866)} = 4.49$$

$$Q_{R1} = \frac{.625 \text{ x } 30 - .0866 \text{ x } 18.75}{2(2 - .0866)200} = .022$$

Panel 2

$$-Q_B = \frac{(.0463 \text{ x } 232 - 134)(.0443 \text{ x } 37.5 - .625\text{x}30)}{2(2 - .0443)134} = 4.02$$

$$-Q_C = \frac{(.625 \text{ x } 30 - .0443 \text{ x } 37.5)}{2(2 - .0443)} = 4.36$$

$$Q_{R2} = \frac{(.625 \text{ x } 30 - .0443 \text{ x } 37.5)}{2(2-.0443)134} = .033$$

Panel 3

$$-Q_C = \frac{(.0507\text{x}136-90)(.0482\text{x}56.25-.625\text{x}30)}{2(2 - .0482)90} = 3.80$$

$$-Q_D = \frac{(.625 \text{ x } 30 - .0482 \text{ x } 56.25)}{2(2 - .0482)} = 4.12$$

$$Q_{R3} = \frac{(.625 \text{ x } 30 - .0482 \text{ x } 56.25)}{2(2 - .0482)90} = .046$$

Panel 4

$$-Q_D = \frac{(-95)(.375 \text{ x } 30)}{4 \text{ x } 95} = -2.81$$

$$-Q_E = \frac{(-.375 \text{ x } 30)}{4} = -2.81$$

$$Q_{R4} = \frac{(-.375 \text{ x } 30)}{4 \text{ x } .95} = .030$$

Panel 5

$$-Q_E = -2.82$$

$$-Q_F = -2.82$$

$$Q_{R5} = -.030$$

Panel 6

$$-Q_F = -2.46$$

$$-Q_G = -2.28$$

$$Q_{R6} = -0.27$$

Panel 7

$$-Q_G = -2.61$$

$$-Q_H = -2.43$$

$$Q_{R7} = -.020$$

Panel 8

$$-Q_H = -2.70$$

$$-Q_I = -2.49$$

$$Q_{R8} = -.014$$

Load at E

Panel 1

$$-Q_A = \frac{(.0942 \times 160 - 200)(.0866 \times 15 - .5 \times 30)}{2(2 - .0866)200} = 3.32$$

$$-Q_B = \frac{(.5 \times 30 - .0866 \times 15)}{2(2 - .0866)} = 3.59$$

$$Q_{R1} = \frac{(.5 \times 30 - .0866 \times 15)}{2(2 - .0866)200} = .018$$

Panel 2

$$-Q_B = \frac{(.0463 \times 232 - 134)(.0443 \times 30 - .5 \times 30)}{2(2 - .0443)134} = 3.22$$

$$-Q_C = \frac{(.5 \times 30 - .0443 \times 30)}{2(2 - .0443)} = 3.49$$

$$Q_{R2} = \frac{(.5 \times 30 - .0443 \times 30)}{2(2 - .0443)134} = .026$$

Panel 3

$$-Q_C = \frac{(.0507 \times 136 - 90)(.0482 \times 45 \; 0.5 \times 30)}{2(2 - .0482)90} = 3.04$$

$$-Q_D = \frac{(.5 \times 30 - .0482 \times 45)}{2(2 - .0482)} = 3.30$$

$$Q_{R3} = \frac{(.5 \times 30 - .0382 \times 45)}{2(2 - .0482)90} = .037$$

Panel 4

$$-Q_D = \frac{(-95)(-.5 \times 30)}{4 \times 95} = 3.75$$

$$-Q_E = \frac{(.5 \times 30)}{4} = 3.75$$

$$Q_{R4} = \frac{.5 \times 30}{4 \times 95} = .040$$

Panel 5

$$-Q_E = -3.78$$

$$-Q_F = -3.78$$

$$Q_{R5} = -.040$$

Panel 6

$$-Q_F = -3.28$$

$$-Q_G = -3.04$$

$$Q_{R6} = -.036$$

Panel 7

$$-Q_G = -3.48$$

$$-Q_H = -3.24$$

$$Q_{R7} = -.026$$

Panel 8

$$-Q_H = -3.60$$

$$-Q_I = -3.32$$

$$Q_{R8} = -.018$$

Panel Constant Computations Load at B

Panel 1

$$\left[1.5x160 + 200 + \frac{(3-.0866)(.0942x160-200)}{2(2-.0866)}\right]A +$$

$$\left[\frac{200}{2} + \frac{(3-.1734)(.0942x160-200)}{2(2-.0866)}\right]B = 5.82$$

$$299A - 37B = 5.82$$

$$\left[200 + 1.5x232 - \frac{(3-.1732)200}{2(2-.0866)}\right]B + \left[\frac{200}{2} - \frac{(3-.0866)200}{2(2-.0866}\right] = 6.28$$

$$400B - 52A = 6.28$$

Solving Simultaneously: $A = .022 \quad B = .019$

$$R_1 = \frac{(3-.0866)(.022) + (3-.1732)(.019)}{2(2-.0866)} + .031 = .062$$

Panel 2

$$\left[1.5x232 + 134 + \frac{(3-.0443)(.0463x232-134)}{2(2-.0443)}\right]B + \left[\frac{134}{2} + \frac{(3-.0886)(.0463x232)^{-134}}{2(2-.0443)}\right]C = -1.11$$

$$\left[134 + 1.5x136 - \frac{(3-.0886)134}{2(2-.0443)}\right]C + \left[\frac{134}{2} - \frac{(3-.0443)134}{2(2-.0443)}\right]B = -1.21$$

$$238C - 34B = -1.21$$

Solving Simultaneously: $B = -.003 \quad C = -.005$

$$R_2 = \frac{(3-.0443)(-.003) + (3-.0886)(-.005)}{2(2-.0443)} - .009 = -.015$$

Panel 3

$$.5\times 136 + 90 + \left[\frac{(3-.0482)(.0507\times 136-90)}{2(2-.0482)}\right]C \left[\frac{90}{2} + \frac{(3-.0964)(.0507\times 136-90)}{2(2-.0482)}\right]$$

$$D = -1.10$$

$$231C - 17D = 1.10$$

$$) + 1.5\times 74 - \left[\frac{(3-.0964)90}{2(2-.0482)}\right]D + \left[\frac{90}{2} - \frac{(3-.0482)90}{2(2-.0482)}\right]C = -1.19$$

$$134D - 23C = -1.19$$

Solving Simultaneously: $C = -.0055; D = -.0098$

$$R_3 = \frac{(3-.0482)(-.0055) + (3-.0964)(-.0098)}{2(2-.0482)} -.013 = -.024$$

anel 4

$$.5\times 74 + 95 + \left[\frac{(3)(0-95)}{4}\right]D + \left[\frac{95}{2} + \frac{(3)(0-95)}{4}\right]E = -.94$$

$$135D - 24E = -.94$$

$$+ 1.5\times 47 - \left[\frac{(3)95}{4}\right]E + \left[\frac{95}{2} - \frac{(3)95}{4}\right]D = -.94$$

$$94E - 24D = -.94$$

Solving Simultaneously $D = -.0092$; $E = -.012$

$$R_4 = \frac{3(-.0092) + 3(-.012)}{4} -.01 = -.026$$

Panel 5

$$135E - 24F = -.94$$

$$-24E + 94F = -.94$$

$$E = -.012$$

$$F = -.0092$$

$$R_5 = \frac{3}{4}(-.0092 - .012) - .0099 = -.026$$

Panel 6

$$134F - 23G = -.82$$

$$-17F + 231G = -.76$$

$$F = -.0068$$

$$G = -.0039$$

$$R_6 = \frac{-2.95x.0039 - 2.90\ x.0068}{3.90} - .0091 = -.0173$$

Panel 7

$$238G - 34H = -.87$$

$$-25G + 389H = -.81$$

$$G = -.0040$$

$$H = -.0023$$

$$R_7 = -\frac{2.96x.0023 - 2.91\ x.0040}{3.91} - .0065 = -.0112$$

Panel 8

$$400H - 52I = -.90$$

$$-37H + 299I = -.83$$

$$H = -.0027$$

$$I = -.0031$$

$$R_8 = -\frac{2.91x.0031 - 2.83\ x.0027}{3.83} - .0045 = -.0088$$

Panel Constant Computations - Load at C

Panel 1

$$299A - 37B = 4.98$$

$$-52A + 400B = 5.38$$

$$A = .019 \ , \ B = .016$$

$$R_1 = \frac{2.91(.019) + 2.83(.016)}{2(1.91)} + .027 = .053$$

Panel 2

$$389B - 25C = 4.82$$

$$-34B + 238C = 5.24$$

$$B = .014 \ , \ C = .024$$

$$R_2 = \frac{2.96(.014) + (2.91)(.024)}{3.92} + .039 = .067$$

Panel 3

$$231C - 17D = -2.20$$

$$-23C + 134D = -2.39$$

$$C = -.011 \ , \ D = -.020$$

$$R_3 = \frac{2.95(-.011) + 2.90(-.020)}{3.90} + (-.027) = -.050$$

Panel 4

$$135D - 24E = -1.87$$

$$-24D + 94E = -1.87$$

$$D = -.018 \ , \ E = -.025$$

$$R_4 = \frac{3(-.018) + 3(-.025)}{4} + (-.020) = -.052$$

Panel 5

$E = -.024$

$F = -.018$

$R_5 = -.052$

Panel 6

$F = -.014$

$G = -.0078$

$R_6 = -.034$

Panel 7

$G = -.0080$

$H = -.0046$

$R_7 = -.022$

Panel 8

$H = -.0054$

$I = -.0062$

$R_8 = -.018$

Panel Constant Computations - Load at PP3

Panel 1

$$299A - 37B = 4.15$$

$$-52A + 400B = 4.49$$

Solving Simultaneously; $A = .016$, $B = .013$

$$R_1 = \frac{2.91(.016) + 2.83(.013)}{3.82} + .022 = .044$$

Panel 2

$$389B - 25C = 4.02$$

$$-34B + 238C = 4.36$$

Solving Simultaneously; $B = .012$, $C = .020$

$$R_2 = \frac{2.96(.012) + 2.91(.020)}{3.92} + .033 = .057$$

Panel 3

$$231C - 17D = 3.80$$

$$-23C + 134D = 4.12$$

Solving Simultaneously; $C = .019$, $D = .034$

$$R_3 = \frac{2.95(.019) + 2.90(.034)}{3.90} + .046 = .086$$

Panel 4

$$135D - 24E = -2.81$$

$$-24D \quad 94E = -2.81$$

Solving Simultaneously; $D = -.027$, $E = -.037$

$$R_4 = \frac{3(-.027) + 3(-.037)}{4} + (-.03) = -.078$$

Panel 5

$E = -.036$

$F = -.028$

$R_5 = -.078$

Panel 6

$F = -.020$

$G = -.012$

$R_6 = -.051$

Panel 7

$G = -.012$

$H = -.0069$

$R_7 = -.033$

Panel 8

$H = -.0081$

$I = -.0093$

$R_8 = -.026$

Panel Constant Computations - Load at E

Panel 1

$$299A - 37B = 3.32$$

$$-52A + 400B = 3.59$$

$$A = .012 \ , \ B = .011$$

$$R_1 = \frac{2.91(.012) + 2.83(.011)}{3.82} + .018 = .035$$

Panel 2

$$389B - 25C = 3.22$$

$$-34B + 238C = 3.49$$

$$B = .009 \ , \ C = .016$$

$$R_2 = \frac{2.96(.009) + 2.91(.016)}{3.92} + .026 = .045$$

Panel 3

$$231C - 17D = 3.04$$

$$-23C + 134D = 3.30$$

$$C = .015 \ , \ D = .027$$

$$R_3 = \frac{2.95(.015) + 2.90(.027)}{3.90} + .037 = .069$$

Panel 4

$$135D - 24E = 3.75$$

$$-24D + 94E = 3.75$$

$$D = .036 \ , \ E = .049$$

$$R_4 = \frac{3(.036) + 3(.049)}{4} + .040 = .10$$

Panel 5

$E = -.048$

$F = -.037$

$R_5 = -.104$

Panel 6

$F = -.027$

$G = -.016$

$R_6 = -.068$

Panel 7

$G = -.016$

$H = -.0092$

$R_7 = -.044$

Panel 8

$H = -.011$

$I = -.012$

$R_8 = -.035$

Moment Determination

Load at PP1 $M = K(A + \frac{B}{2} - R)$ FM_{AB}

Panel 1

$M_{AB} = 200(.022 + \frac{.019}{2} - .062)$ $M_{AB} = -6.0$

$M_{BA} = 200(.019 + \frac{.022}{2} - .062)$ $M_{BA} = -6.4$

Panel 2

$M_{BC} = 134(-.003 - \frac{.005}{2} + .015)$ $M_{BC} = +1.21$

$M_{CB} = 134(-.005 - \frac{.003}{2} + .015)$ $M_{CB} = +1.07$

Panel 3

$M_{CD} = 90(-.0055 - \frac{.0098}{2} + .024)$ $M_{CD} = +1.26$

$M_{DC} = 90(-.0098 - \frac{.0055}{2} + .024)$ $M_{DC} = +0.99$

Panel 4

$M_{DE} = 95(-.0092 - \frac{.012}{2} + .026)$ $M_{DE} = +1.05$

$M_{ED} = 95(-.012 - \frac{.0092}{2} + .026)$ $M_{ED} = +.86$

Panel 5

$M_{EF} = 2.58$

$M_{FE} = 2.97$

Panel 6

$M_{FG} = 2.16$

$M_{GF} = 2.70$

Panel 7

$M_{GH} = 2.40$

$M_{HG} = 2.82$

Panel 8

$M_{HI} = 2.76$

$M_{IH} = 2.58$

Load at PP2

Panel 1

$$M_{AB} = 200(.019 + \frac{.016}{2} - .053) \qquad M_{AB} = -5.20$$

$$M_{BA} = 200(.016 + \frac{.019}{2} - .053) \qquad M_{BA} = -5.40$$

Panel 2

$$M_{BC} = 134(.014 + \frac{.024}{2} - .067) \qquad M_{BC} = -5.49$$

$$M_{CB} = 134(.024 + \frac{.014}{2} - .067) \qquad M_{CB} = -4.82$$

Panel 3

$$M_{CD} = 90(-.011 - \frac{.020}{2} + .050) \qquad M_{CD} = +2.61$$

$$M_{DC} = 90(-.020 - \frac{.011}{2} + .050) \qquad M_{DC} = +2.16$$

Panel 4

$$M_{DE} = 95(-.018 - \frac{.025}{2} + .052) \qquad M_{DE} = +2.09$$

$$M_{ED} = 95(-.025 - \frac{.018}{2} + .052) \qquad M_{ED} = +1.71$$

Panel 5

$$M_{EF} = 3.44$$

$$M_{FE} = 3.96$$

Panel 6

$$M_{FG} = 2.88$$

$$M_{GF} = 3.60$$

Panel 7

$$M_{GH} = 3.20$$

$$M_{HG} = 3.76$$

Panel 8

$$M_{HI} = 3.68$$

$$M_{IH} = 3.44$$

Load at PP3

Panel 1

$$M_{AB} = 200(.016 + \frac{.013}{2} - .044) \qquad M_{AB} = -4.40$$

$$M_{BA} = 200(.013 + \frac{.016}{2} - .044) \qquad M_{BA} = -4.60$$

Panel 2

$$M_{BC} = 134(.012 + \frac{.020}{2} - .057) \qquad M_{BC} = -4.69$$

$$M_{CB} = 134(.020 + \frac{.012}{2} - .057) \qquad M_{CB} = -4.15$$

Panel 3

$$M_{CD} = 90(.019 + \frac{.034}{2} - .086) \qquad M_{CD} = -4.50$$

$$M_{DC} = 90(.034 + \frac{.019}{2} - .086) \qquad M_{DC} = -3.78$$

Panel 4

$$M_{DE} = 95(-.027 - \frac{.037}{2} + .078) \qquad M_{DE} = 3.14$$

$$M_{ED} = 95(-.037 - \frac{.027}{2} + .078) \qquad M_{ED} = 2.56$$

Panel 5

$$M_{EF} = 95(-.012 - \frac{.0092}{2} + .026) \qquad M_{EF} = .86$$

$$M_{FE} = 95(-.0092 - \frac{.012}{2} + .026) \qquad M_{FE} = .99$$

Panel 6

$$M_{FG} = 90(-.0068 - \frac{.0039}{2} + .017) \qquad M_{FG} = .72$$

$$M_{GF} = 90(-.0039 - \frac{.0068}{2} + .017) \qquad M_{GF} = .90$$

Panel 7

$$M_{GH} = 134(-.0040 - \frac{.0023}{2} + .011) \qquad M_{GH} = .80$$

$$M_{HG} = 134(-.0023 - \frac{.0040}{2} + .011) \qquad M_{HG} = .94$$

Panel 8

$$M_{HI} = 200(-.0027 - \frac{.0031}{2} + .0088) \qquad M_{HI} = .92$$

$$M_{IH} = 200(-.0031 - \frac{.0027}{2} + .0088) \qquad M_{IH} = .86$$

Load at PP4

Panel 1

$$M_{AB} = 200(.012 + \frac{.011}{2} - .035) \qquad M_{AB} = -3.40$$

$$M_{BA} = 200(.011 + \frac{.012}{2} - .035) \qquad M_{BA} = -3.60$$

Panel 2

$$M_{BC} = 134(.009 + \frac{.016}{2} - .045) \qquad M_{BC} = -3.75$$

$$M_{CB} = 134(.016 + \frac{.009}{2} - .045) \qquad M_{CB} = -3.35$$

Panel 3

$$M_{CD} = 90(.015 + \frac{.027}{2} - .069) \qquad M_{CD} = -3.69$$

$$M_{DC} = 90(.027 + \frac{.015}{2} - .069) \qquad M_{DC} = -3.15$$

Panel 4

$$M_{DE} = 95(.036 + \frac{.049}{2} - 0.10) \qquad M_{DE} = -3.80$$

$$M_{ED} = 95(.049 + \frac{.036}{2} - 0.10) \qquad M_{ED} = -3.13$$

Panel 5

$$M_{EF} = 1.72$$

$$M_{FE} = 1.98$$

Panel 6

$$M_{FG} = 1.44$$

$$M_{GF} = 1.80$$

Panel 7

$$M_{GH} = 1.60$$

$$M_{HG} = 1.88$$

Panel 8

$$M_{HI} = 1.84$$

$$M_{IH} = 1.72$$

First Moment Corrections - Load at B

1 - $299A - 37B = 0$

$-52A + 400B = -1.21$

$A = -.00038$

$B = -.0031$

$$R_1 = \frac{-2.91x.00038 - 2.83x.0031}{3.83} = -.0026$$

$M_{AB} = 200(-.00038 - \tfrac{1}{2}x.0031 + .0026) = 0.14$

$M_{BA} = 200(-.0031 - \tfrac{1}{2}x.00038 + .0026) = -0.14$

2 - $388B - 25C = 6.4$

$-34B + 238C = -1.26$

$B = .016$

$C = -.0030$

$$R_2 = \frac{2.96x.016 - 2.91x.003}{3.91} = .0099$$

$M_{BC} = 134(.016 - \tfrac{1}{2}x.0030 - .0099) = 0.62$

$M_{CB} = 134(-.0030 + \tfrac{1}{2}x.016 - .0099) = -0.66$

3 $271C - 17D = -1.07$

$-23C + 134D = -1.05$

$C = -.0055$

$D = -.0088$

$$R_3 = \frac{-2.95x.0055 - 2.90x.0088}{3.90} = -.011$$

$M_{CD} = 90(-.0055 - \tfrac{1}{2}x.0088 + .011) = 0.072$

$M_{DC} = 90(-.0088 - \tfrac{1}{2}x.0055 + .011) = -0.072$

4 -

$$94D - 24E = -.99$$

$$-24D + 135E = -.86$$

$$D = -.013$$

$$E = -.0086$$

$$R_4 = \frac{3}{4}(-.013 - .0086) = -.016$$

$$M_{DE} = 95(-.013 - \tfrac{1}{2}x.0086 + .016) = -.10$$

$$M_{ED} = 95(-.0086 - \tfrac{1}{2}x.013 + .016) = +.10$$

5 -

$$135E - 24F = -.86$$

$$-24E + 94F = -.72$$

$$E = -.0080$$

$$F = -.0097$$

$$R_5 = \frac{3}{4}(-.0080 - .0097) = -.013$$

$$M_{EF} = 95(-.0080 - \tfrac{1}{2}x.0097 + .013) = .05$$

$$M_{FE} = 95(-.0097 - \tfrac{1}{2}x.0080 + .013) = -.04$$

6 -

$$134F - 23G = -.99$$

$$-17F + 231G = -.80$$

$$F = -.0079$$

$$G = -.0040$$

$$R_6 = \frac{-2.90x.0079 - 2.95x.0040}{3.90} = -.0090$$

$$M_{FG} = 90(-.0079 - \tfrac{1}{2}x.0040 + .0090) = -.08$$

$$M_{GF} = 90(-.0040 - \tfrac{1}{2}x.0079 + .0090) = .09$$

7 - $$238G - 34H = -.90$$

$$-25G + 388H = -.92$$

$$G = -.0040$$

$$H = -.0026$$

$$R_7 = \frac{-2.91x.0040 - 2.96x.0026}{3.91} = -.0049$$

$$M_{GH} = 134(-.0040 - \tfrac{1}{2}x.0026 + .0049) = -.05$$

$$M_{HG} = 134(-.0026 - \tfrac{1}{2}x.0040 + .0049) = .04$$

8 - $$400H - 52I = -.94$$

$$-37H + 299I = 0.00$$

$$H = -.0024$$

$$I = -.0003$$

$$R_8 = \frac{-2.83x.0024 - 2.91x.0003}{3.83} = -.0020$$

$$M_{HI} = 200(-.0024 - \tfrac{1}{2}x.0003 + .0020) = -0.10$$

$$M_{IH} = 200(-.0003 - \tfrac{1}{2}x.0024 + .0020) = 0.10$$

Load at B

Panel	1		2		3		4	
Joint	A	B	B	C	C	D	D	E
-Q	5.82	6.28	-1.11	-1.21	-1.10	-1.19	- .94	- .94
α	.022	.019	-.003	-.005	-.0055	-.0098	-.0092	-.012
R	.062		-.015		-.024		-.026	
M'	-6.0	-6.4	1.21	1.07	1.26	0.99	1.05	0.86
-Q	0.00	-1.21	6.4	-1.26	-1.07	-1.05	-0.99	-0.86
α	-.0004	.0031	0.16	-.0030	-.0055	-.0088	-.013	-.0086
R	-.0026		-.0099		-.011		-.016	
M"	0.14	-0.14	0.62	-0.66	0.07	-0.07	- .10	.10
-Q								
α								
R								
M'''								
M	-5.86	-6.54	1.83	0.41	1.33	0.92	0.95	0.96

5		6		7		8	
E	F	F	G	G	H	H	I
-0.94	-0.94	-0.82	-0.76	-0.87	-0.81	-0.90	-0.83
-0.12	-.0092	-.0068	-.0039	-.0040	-.0023	-.0027	-.0031
-.026		-.017		-.011		-.0088	
0.86	0.99	0.72	0.90	0.80	0.94	0.92	0.86
-0.86	-0.72	-0.99	-0.80	-0.90	-0.92	-0.94	0.00
-.0080	-.0097	-.0079	-.0040	-.0040	-.0026	-.0024	-.0003
-.013		-.0090		-.0049		-.0020	
.05	- .04	- .08	.09	- .05	.04	- .10	.10
0.91	0.95	0.64	0.99	0.75	0.98	0.82	0.96

First Moment Corrections - Load at C

1.

$$299A - 37B = 0$$
$$-52A + 400B = 5.49'$$

$$A = .0017$$
$$B = .014$$
$$R_1 = \frac{2.91 \text{ x}.0017 + 2.83 \text{ x}.014}{3.83} = .012$$

$$M_{AB} = 200(.0017 + \frac{1}{2} \text{ x}.014 - .012) = -.60$$
$$M_{BA} = 200(.014 + \frac{1}{2} \text{ x}.0017 - .012) = .60$$

2.

$$388B - 25C = 5.40$$
$$-34B + 238C = -2.61$$

$$B = .013$$
$$C = -.0091$$
$$R_2 = \frac{2.96 \text{ x}.013 - 2.91 \text{ x}.0091}{3.91} = .0031$$

$$M_{BC} = 134(.013 - \frac{1}{2} \text{ x}.0091 - .0031) = .67$$
$$M_{CB} = 134(-.0091 + \frac{1}{2} \text{ x}.013 - .0031) = -.71$$

3.

$$231C - 17D = 4.82$$
$$-23C + 134D = -2.09$$

$$C = .020$$
$$D = .012$$

$$R_3 = \frac{2.95 \text{ x}.02 - 2.90 \text{ x}.012}{3.90} = .0062$$

$$M_{CD} = 90(.020 - \frac{1}{2} \text{ x}.012 - .0062) = .72$$
$$M_{DC} = 90(-.012 + \frac{1}{2} \text{ x}.020 - .0062) = -.72$$

4.

$$94D - 24E = -2.16$$
$$-24D + 135E = -1.72$$

$$D = -.028$$
$$E = -.018$$

$$R_4 = \frac{3}{4}(-.028 - .018) = -.035$$
$$M_{DE} = 95(-.028 - \frac{1}{2} \text{ x}.018 + .035) = -.23$$

$$M_{ED} = 95(-.018 - \frac{1}{2} \text{ x}.028 + .035) = .23$$

5.

$$135E - 24F = -1.71$$
$$-24E + 94F = -1.44$$
$$E = -.016$$
$$F = -.019$$

$$R_5 = \frac{3}{4}(-.016 - .019) = -.026$$

$$M_{EF} = 95(-.016 - \frac{1}{2} x.019 + .026) = .10$$

$$M_{FE} = 95(-.016 - \frac{1}{2} x.019 + .026) = -.10$$

6.

$$134F - 23G = -1.98$$
$$-17F + 231G = -1.60$$
$$F = -.016$$
$$G = -.008$$

$$R_6 = \frac{-2.90 x.008 - 2.95 x.016}{3.90} = -.018$$

$$M_{FG} = 90(-0.16 - \frac{1}{2} x.008 + .018) = -.18$$

$$M_{GF} = 90(-.008 - \frac{1}{2} x.016 + .018) = .18$$

7.

$$238G - 34H = -1.80$$
$$-25G + 388H = -1.84$$
$$G = .0080$$
$$H = .0052$$

$$R_7 = \frac{-2.91 x.0080 - 2.96 x.0052}{3.91} = -.0098$$

$$M_{GH} = 134(-.0080 - \frac{1}{2} x.0052 + .0098) = -.09$$

$$M_{HG} = 134(-.0080 - \frac{1}{2} x.0052 + .0098) = .09$$

8.

$$400H - 52I = -1.88$$
$$-37H + 299I = 0$$
$$H = -.0049$$
$$I = -.0006$$

$$R_8 = \frac{-2.83 x.0049 - 2.91 x.0006}{3.83} = -.0040$$

$$M_{HI} = 200(-.0049 - \frac{1}{2} x.0006 + .0040) = -.20$$

$$M_{IH} = 200(-.0006 - \frac{1}{2} x.0049 + .0040) = .20$$

Second Moment Corrections-Load at C

1.

$$299A - 37B = 0$$
$$-52A + 400B = -.67$$
$$A = -.0002$$
$$B = -.0017$$

$$R_1 = -\frac{2.91 \times .0002 - 2.83 \times .0017}{3.83} = -.0014$$

$$M_{AB} = 200(-.0002 - \frac{1}{2} \times .0017 + .0014) = .08$$

$$M_{BA} = 200(-.0017 - \frac{1}{2} \times .0002 + .0014) = -.08$$

2.

$$388B - 25C = -.67$$
$$-34B + 238C = -.72$$
$$B = -.0020$$
$$C = -.0033$$

$$R_2 = -\frac{2.96 \times .0020 - 2.91 \times .0033}{3.91} = -.0040$$

$$M_{BC} = 134(-.0020 - \frac{1}{2} \times .0033 + .0040) = .05$$

$$M_{CB} = 134(-.0033 - \frac{1}{2} \times .0020 + .0040) = -.04$$

3.

$$231C - 17D = .71$$
$$-23C + 134D = .23$$
$$C = .0023$$
$$D = .0033$$

$$R_3 = \frac{2.95 \times .0023 + 2.90 \times .0033}{3.90} = .0042$$

$$M_{CD} = 90(.0023 + \frac{1}{2} \times .0033 - .0042) = -.03$$

$$M_{DC} = 90(.0033 + \frac{1}{2} \times .0023 - .0042) = .03$$

4.

$$94D - 24E = .72$$
$$-24D + 135E = -.10$$
$$D = .0076$$
$$E = .0006$$

$$R_4 = \frac{3}{4}(.0076 + .0006) = .0062$$

$$M_{DE} = 95(.0076 + \frac{1}{2} \times .0006 - .0062) = .16$$

$$M_{ED} = 95(.0006 + \frac{1}{2} \times .0076 - .0062) = -.16$$

Load at C

Panel	1		2		3		4	
Joint	A	B	B	C	C	D	D	E
Q	4.98	5.38	4.82	5.24	-2.20	-2.39	-1.87	-1.87
α	.019	.016	.014	.024	-.011	-.020	-.018	-.025
R	.053		.067		-.050		-.052	
M''	-5.20	-5.40	-5.49	-4.82	2.61	2.16	2.09	1.71
Q	0.00	5.49	5.40	-2.61	4.82	-2.09	-2.16	-1.72
α	.0017	.014	.013	-.0091	.020	-0.12	-0.28	-.018
R	.012		-.0031		.0062		-.035	
M''	- .60	.60	.67	- .71	.72	- .72	- .23	.23
Q	0.00	- .67	- .67	- .72	.71	.23	.72	- .10
α	-.0002	-.0017	-.0020	-.0033	.0023	.0033	.0076	.0006
R	-.0014		-.0040		.0042		.0062	
M''	.08	- .08	.05	- .04	- .03	.03	.16	- .16
M	-5.72	-4.88	-4.77	-5.57	3.29	1.47	2.02	1.78

5		6		7		8	
E	F	F	G	G	H	H	I
-1.88	-1.88	-1.64	-1.52	-1.74	-1.62	-1.80	-1.66
-.024	-.018	-.014	-.0078	-.0080	-.0046	-.0054	-.0062
-.052		-.034		-.022		-.018	
1.72	1.98	1.44	1.80	1.60	1.88	1.84	1.72
-1.71	-1.44	-1.98	-1.60	-1.80	-1.84	-1.88	0.00
-.016	-.019	-.016	-.008	-.0080	-.0052	-.0049	-.0006
-.026		-.018		-.0098		-.0042	
.10	- .10	- .18	.18	- .09	.09	- .20	.20
1.82	1.88	1.26	1.98	1.51	1.97	1.64	1.92

Influence Lines - First Correction

Load at D

Panel 1

$$299A - 37B = 0$$
$$-52A + 400B = 4.69$$
$$A = .001$$
$$B = .012$$
$$R_1 = .010$$

$$M_{AB} = 200(.001 + \tfrac{1}{2}x.012 - .01) = -.60$$
$$M_{BA} = 200(.012 + \tfrac{1}{2}x.001 - .01) = .60$$

Panel 2

$$389B - 25C = 4.60$$
$$-34B + 238C = 4.50$$
$$B = .013$$
$$C = .021$$
$$R_2 = .025$$

$$M_{BC} = 134(.013 + \tfrac{1}{2}x.021 - .025) = -.27$$
$$M_{CB} = 134(.021 + \tfrac{1}{2}x.013 - .025) = .27$$

Panel 3

$$231C - 17D = 4.15$$
$$-23C + 134D = -3.14$$
$$C = .016$$
$$D = -.021$$
$$R_3 = -.003$$

$$M_{CD} = 90(.016 - \tfrac{1}{2}x.021 + .003) = .81$$
$$M_{DC} = 90(-.021 + \tfrac{1}{2}x.016 + .003) = -.90$$

Panel 4

$$135D - 24E = 3.78$$
$$-24D + 94E = -2.58$$
$$D = .024$$
$$E = -.021$$
$$R_4 = .002$$

$$M_{DE} = 95(.024 - \tfrac{1}{2}x.021 - .002) = 1.14$$
$$M_{ED} = 95(-.021 + \tfrac{1}{2}x.024 - .002) = -1.04$$

Panel 5

$$-24F + 94E = -2.56$$
$$135F - 24E = -2.16$$
$$E = -.033$$
$$F = -.022$$
$$R_5 = -.041$$

$$M_{EF} = 95(-.033 - \tfrac{1}{2}x.022 + .041) = -.28$$

$$M_{FE} = 95(-.022 - \tfrac{1}{2}x.033 + .041) = .28$$

Panel 6

$$-23G + 134F = -2.97$$
$$231G - 17F = -2.40$$
$$F = -.024$$
$$G = -.012$$
$$R_6 = -.027$$

$$M_{FG} = 90(-.024 - \tfrac{1}{2}x.012 + .027) = -.27$$

$$M_{GF} = 90(-.012 - \tfrac{1}{2}x.024 + .027) = .27$$

Panel 7

$$-34H + 238G = -2.70$$
$$389H - 25G = -2.76$$
$$G = -.012$$
$$H = -.008$$
$$R_7 = -.015$$

$$M_{GH} = 134(-.012 - \tfrac{1}{2}x.008 + .015) = -.13$$

$$M_{HG} = 134(-.008 - \tfrac{1}{2}x.012 + .015) = .13$$

Panel 8

$$-52I + 400H = -2.82$$
$$299I - 37H = 0$$
$$H = -.001$$
$$I = -.007$$
$$R_8 = -.005$$

$$M_{HI} = 200(0 - \tfrac{1}{2}x.007 + .005) = .40$$

$$M_{IH} = 200(-.007 - \tfrac{1}{2}x0 + .005) = -.40$$

Influence Lines - Second Correction - Load at D

Panel 1

$$299A - 37B = 0$$
$$-53A + 400B = .27$$

$A = 0$ $\quad$ $B = .0007$ $\quad$ $R_1 = 0$

$M_{AB} = 0$ $\quad$ $M_{BA} = 0$

Panel 2

$$389B - 25C = -.60$$
$$-34B + 238C = -.81$$
$$B = -.0018$$
$$C = -.0037$$
$$R_2 = -.0041$$

$$M_{BC} = 134(-.0018 - \tfrac{1}{2}x.0037 + .0041) = .07$$
$$M_{CB} = 134(-.0037 - \tfrac{1}{2}x.0018 + .0041) = -.07$$

Panel 3

$$231C - 17D = -.27$$
$$-23C + 134D = -1.14$$
$$C = -.0019$$
$$D = -.0088$$
$$R_3 = -.0080$$

$$M_{CD} = 90(-.0019 - \tfrac{1}{2}x.0088 + .0080) = .15$$
$$M_{DC} = 90(-.0088 - \tfrac{1}{2}x.0019 + .0080) = -.15$$

Panel 4

$$135D - 24E = .90$$
$$-24D + 94E = .28$$
$$D = .0076$$
$$E = .0049$$
$$R_4 = .0094$$

$$M_{DE} = 95(.0076 + \tfrac{1}{2}x.0049 - .0094) = .07$$

$$M_{ED} = 95(.0049 + \tfrac{1}{2}x.0076 - .0094) = -.07$$

Panel 5

$$-24F + 94E = 1.04$$
$$135F - 24E = .27$$
$$E = .0121$$
$$F = .0042$$
$$R_5 = .0122$$

$$M_{EF} = 95(.0121 + \tfrac{1}{2}x.0042 - .0122) = .19$$

$$M_{FE} = 95(.0042 + \tfrac{1}{2}x.0121 - .0122) = -.19$$

Panel 6

$$-23G + 134F = -.28$$
$$231G - 17F = .13$$
$$F = -.0020$$
$$G = .0004$$
$$R_6 = -.0012$$

$$M_{FG} = 90(-.0020 + \tfrac{1}{2}x.0004 + .0012) = -.05$$

$$M_{GF} = 90(.0004 - \tfrac{1}{2}x.0020 + .0012) = .05$$

Panel 7

$$-34H + 238G = -.27$$
$$389H - 25G = -.40$$
$$G = -.0013$$
$$H = -.0011$$
$$R_7 = -.0018$$

$$M_{GH} = 134(-.0013 - \tfrac{1}{2}x.0011 + .0018) = 0$$

$$M_{HG} = 134(-.0011 - \tfrac{1}{2}x.0013 + .0018) = 0$$

Panel 8

$$-52I + 400H = -.13$$
$$299I - 37H = 0$$

$H = -.0003$ $\quad R_8 = 0$ $\quad M_{IH} = 0$

$I = 0$ $\quad M_{HI} = 0$

Load at PP3

Panel	1		2		3		4	
Joint	A	B	B	C	C	D	D	E
-Q	4.15	4.49	4.02	4.36	3.80	4.12	-2.88	-2.81
α	.016	.013	.012	.020	.019	.034	-.027	-.037
R	.044		.057		.086		-.078	
M'	-4.40	-4.60	-4.69	-4.15	-4.50	-3.78	3.14	2.56
-Q	0	4.69	4.60	4.50	4.15	-3.14	3.78	-2.58
α	.001	.012	.031	.021	.016	-.021	.024	-.021
R	.010		.025		-.003		.002	
M"	-.60	.60	-.27	.27	.81	-.90	1.14	-1.04
-Q	0	.27	-.60	-.81	-.27	-1.14	.90	.28
α	0	.0007	-.0018	-.0037	-.0019	-.0088	.0076	.0049
R	0		-.0041		-.0080		.0094	
M"'	0	0	.07	-.07	.15	-.15	.07	-.07
M	-5.00	-4.00	-4.89	-3.95	-3.54	-4.83	4.35	1.45

5		6		7		8	
E	F	F	G	G	H	H	I
-2.82	-2.82	-2.46	-2.28	-2.61	-2.43	-2.70	-2.49
-.036	-.028	-.020	-.012	-.012	-.007	-.008	-.009
-.078		-.051		-.033		-.026	
2.58	2.97	2.16	2.70	2.40	2.82	2.76	2.58
-2.56	-2.16	-2.97	-2.40	-2.70	-2.76	-2.82	0
-.035	-.022	-.024	-.012	-.012	-.008	-.001	-.007
-.041		-.027		-.015		-.005	
- .28	.28	- .27	.27	- .13	.13	.40	- .40
1.04	.27	- .28	.13	- .27	- .40	- .13	0
.0121	.0042	-.0020	.0004	-.0013	-.0011	-.0003	0
.0122		-.0012		-.0018		0	
.19	- .19	- .05	.05	0	0	0	0
2.49	3.06	1.84	3.02	2.27	2.95	3.16	2.18

Influence Lines First Correction Load at E

Panel 1, 8

$$299A - 37B = 0$$
$$-52A + 400B = 3.76$$
$$A = .0012$$
$$B = .0095$$
$$R_1 = .0079$$

$$M_{AB} = 200(.0012 + \frac{1}{2} x.0095 - .0079 = -.40$$

$$M_{BA} = 200(.0095 + \frac{1}{2} x.0012 - .0079) = .40$$

Panel 2, 7

$$389B - 25C = -.21$$
$$-34B + 238C = 3.60$$
$$B = .0105$$
$$C = .0172$$
$$R_2 = .208$$

$$M_{BC} = 134(.0105 + \frac{1}{2} x.0172 - .0208) = -.21$$

$$M_{CB} = 134(.0172 + \frac{1}{2} x.0105 - .0208) = .21$$

Panel 3, 6

$$231C - 17D = 3.20$$
$$-23C + 134D = 3.96$$
$$C = .0162$$
$$D = .0324$$
$$R_3 = .0364$$

$$M_{CD} = 90(.0162 + \frac{1}{2} x.0324 - .0362) = -.36$$

$$M_{DC} = 90(.0324 + \frac{1}{2} x.0162 - .0362) = .36$$

Panel 4, 5

$$135D - 24E = 2.88$$
$$-24D + 94E = -3.44$$
$$D = .0155$$
$$E = -.0326$$
$$R_4 = -.0128$$

$$M_{DE} = 95(.0155 - \frac{1}{2} x.0326 + .0128) = 1.14$$

$$M_{ED} = 95(-.0326 - \frac{1}{2} x.0155 + .0128) = -1.14$$

Influence Lines - Second Correction - Load at E

Panel 1,8

$$299A - 37B = 0$$
$$-52A + 400B = .21$$
$$A = .00007$$
$$B = .00053$$
$$R_1 = .00044$$

$$M_{AB} = 200(.00007 + \tfrac{1}{2}x.00053 - .00044) = -.02$$
$$M_{BA} = 200(.00053 + \tfrac{1}{2}x.00007 - .00044) = .02$$

Panel 2,7

$$389B - 25C = -.40$$
$$-34B + 238C = .36$$
$$B = -.00094$$
$$C = .00132$$
$$R_2 = .00027$$

$$M_{BC} = 134(-.00094 + \tfrac{1}{2}x.00132 - .00027) = -.08$$
$$M_{CB} = 134(.00132 - \tfrac{1}{2}x.00094 - .00027) = .08$$

Panel 3,6

$$231C - 17D = -.21$$
$$-23C + 134D = -1.14$$
$$C = -.0016$$
$$D = -.0088$$
$$R_3 = -.0077$$

$$M_{CD} = 90(-.0016 - \tfrac{1}{2}x.0088 + .0077) = .16$$
$$M_{DC} = 90(-.0088 - \tfrac{1}{2}x.0016 + .0077) = -.16$$

Panel 4,5

$$135D - 24E = -.21$$
$$-24D + 94E = 0$$
$$D = -.0016$$
$$E = -.0004$$
$$R_4 = -.0015$$

$$M_{DE} = 95(-.0016 - \tfrac{1}{2}x.0004 + .0015) = -.03$$
$$M_{ED} = 95(-.0004 - \tfrac{1}{2}x.0016 + .0015) = .03$$

Load at PP-4

Panel	1		2		3		4	
Joint	A	B	B	C	C	D	D	E
-Q	3.32	3.59	3.22	3.49	3.04	3.30	3.75	3.75
α	.012	.011	.009	.016	.015	.017	.036	.049
R	.035		.045		.069		.10	
M'	-3.44	-3.68	-3.76	-3.20	-3.60	-2.88	-3.96	-3.44
-Q	0	3.76	3.68	3.60	3.20	3.96	2.88	-3.44
α	.0022	.0095	.0105	.0172	.0162	.0324	.0155	-.0326
R	.0079		.0208		.0364		-.0128	
M''	- .40	.40	- .21	.21	- .36	.36	1.14	-1.14
-Q	0	.21	- .40	.36	- .21	-1.14	- .36	-1.14
α	.00007	.00053	.00049	.00132	-.0016	-.0088	-.0016	-.0004
R	.00044		.00027		-.0077		-.0015	
M'''	- .02	.02	- .08	.08	.16	- .16	- .03	.03
ΣM	-3.86	-3.26	-4.05	-2.91	-3.80	-2.68	-2.85	-4.55

5		6		7		8	
E	F	F	G	G	H	H	I
-3.73	-3.78	-3.28	-3.04	-3.48	-3.24	-3.60	-3.32
-.049	-.036	-.027	-.015	-.016	-.009	-.011	-.012
-.10		-.069		-.045		-.035	
3.44	3.96	2.88	3.60	3.20	3.76	3.68	3.44
3.44	-2.88	-3.96	-3.20	-3.60	-3.68	-3.76	0
.0326	-.0155	-.0324	-.0162	-.0172	-.0105	-.0095	-.0012
.0128		-.0364		-.0208		-.0079	
1.14	-1.14	- .36	.36	- .21	.21	- .40	.40
1.14	.36	1.14	.21	- .36	.40	- .21	0
.0004	.0016	.0088	.0016	-.00132	.00094	-.00053	-.00007
.0015		.0077		-.00027		-.00044	
- .03	.03	.16	- .16	- .08	.08	- .02	.02
4.55	2.85	2.68	3.80	2.91	4.05	3.26	3.86

Moment Computations - Web Members

Member AA'

Dh	=	3140 fk
hh E-60	=	2755
Impact	=	590
Total		6485
hh H-15-S12-44	=	367
Conc.	=	86
Impact	=	62
Total		515
Sidewalk	=	222
Design Moment	=	11,762 fk

Member BB'

Dh	=	5180 fk
hh E-60	=	4423
Impact	=	947
Total		10,550
hh H15-S12-44	=	606
Conc.	=	142
Impact	=	102
Total		850
Sidewalk	=	362
Design Moment	=	11,762 fk

Member CC'

Dh	=	3258 fk
hh E-60	=	2882
Impact	=	626
Total		6766
hh H15-S12-44	=	381
Conc.	=	109
Impact	=	77
Total		567
Sidewalk	=	242
Design Moment	=	7,575 fk

Member DD

Dh	=	1830
hh-E-60	=	1652
Impact	=	436
Total		3948
hh H15-S12-44	=	215
Conc.	=	79
Impact	=	53
Total		347
Sidewalk	=	152
Design Moment	=	4,447

Member EE'

Dh	=	1156 fk
hh-E-60	=	1110
Impact	=	389
Total		2655
hh H15-S12-44	=	135
Conc.	=	64
Impact	=	42
Total		241
Sidewalk	=	104
Design Moment	=	3000 fk

Moment Computations - Chord Members

Member AB

DL	=	3140 fk
LL-E60	=	2755
Impact	=	590
Total		6485
LL H15-S12-44	=	367
Conc.	=	86
Impact	=	62
Total		515
Sidewalk	=	222
Design Moment	=	7,222

Member BC

DL	=	2330 fk
LL-E60	=	2128
Impact	=	454
Total		4912
LL H15-S12-44	=	273
Conc.	=	80
Impact	=	55
Total		408
Sidewalk	=	172
Design Moment	=	5,492 fk

Member CD

DL	=	1525 fk
LL-E60	=	1382
Impact	=	321
Total	=	3128
LL H15-S12-44	=	179
Conc.	=	61
Impact	=	41
Total	=	281
Sidewalk	=	120
Design Moment	=	3,529 fk

Member DE

DL	=	1135 fk
LL-E60	=	1088
Impact	=	327
Total	=	2550
LL H15-S12-44	=	133
Conc.	=	62
Impact	=	37
Total	=	232
Sidewalk	=	95
Design Moment	=	2,877 fk

Influence Line Computations

Load at B

Panel #1

$$-Q_A = \frac{(.0942 - 1)(.0866x26.25 - .875x30)}{2(2 - .0866)1} = 5.77$$

$$-Q_B = \frac{(.875x30 - .0866x26.25)}{2(2 - .0866)} = 6.28$$

$$Q_{R_1} = \frac{.875x30 - .0866x26.25}{2(2 - .0866)1} = 6.28$$

Panel #2

$$-Q_B = \frac{(.0463 - 1)(.0443x22.5 + .125x30)}{2(2 - .0443)} = -1.15$$

$$-Q_C = \frac{(-.125x30 - .0443x22.5)}{2(2 - .0443)} = -1.21$$

$$Q_{R_2} = \frac{-.125x30 - .0443x22.5}{2(2 - .0443)1} = -1.21$$

Panel #3

$$-Q_C = \frac{(.0507 - 1)(.0482x18.75 + .125x30)}{2(2 - .0482)1} = -1.13$$

$$-Q_D = \frac{-.125x30 - .0482x18.75}{2(2 - .0482)} = -1.19$$

$$Q_{R_3} = \frac{-.125x30 - .0482x18.75}{2(2 - .0482)1} = -1.19$$

Panel #4

$$-Q_D = \frac{-1(.125x30)}{4} = -.94$$

$$-Q_E = \frac{-.125x30}{4} = -.94$$

$$Q_{R_4} = \frac{-.125x30}{4} = -.94$$

Panel 5

$$-Q_E = \frac{-.125x30}{4} = -0.94$$

$$-Q_F = \frac{-.125x30}{4} = -0.94$$

$$Q_{R_5} = \frac{-.125x30}{4x1} = -0.94$$

Panel 6

$$-Q_G = \frac{(.0507x1 - 1)(-.0482x11.25 + .125x30)}{2(2 - .0482)1} = -0.78$$

$$-Q_F = \frac{(-.125x30 + .0482x11.25)}{2(2 - .0482)} = -0.82$$

$$Q_{R_6} = \frac{(-.125x30 + .0482x11.25)}{2(2 - .0482)1} = -0.82$$

Panel 7

$$-Q_H = \frac{(.0463x1 - 1)(-.0443x7.5 + .125x30)}{2(2 - .0443)1} = -0.83$$

$$-Q_G = \frac{(-.125x30 + .0443x7.5)}{2(2 - .0443)} = -0.87$$

$$Q_{R_7} = \frac{(-.125x30 + .0443x7.5)}{2(2 - .0443)1} = -0.87$$

Panel 8

$$-Q_I = \frac{(.0942x1 - 1)(-.0866x3.75 + .125x30)}{2(2 - .0866)1} = -0.81$$

$$-Q_H = \frac{(-.125x30 + .0866x3.75)}{2(2 - .0866)} = -0.90$$

$$Q_{R_8} = \frac{(-.125x30 + .0866x3.75)}{2(2 - .0866)} = -0.90$$

Load at C

Panel 1

$$-Q_A = \frac{(.0942 - 1)(.0866x22.5 - .75x30)}{2(2 - .0866)1} = 4.89$$

$$-Q_B = \frac{(.75x30 - .0866x22.5)}{2(2 - .0866)} = 5.38$$

$$Q_{R_1} = \frac{.75x30 - .0866x22.5}{2(2 - .0866)1} = 5.38$$

Panel 2

$$-Q_B = \frac{(.0463 - 1)(.0443x45 - .75x30)}{2(2 - .0443)1} = 4.96$$

$$-Q_C = \frac{(.75x30 - .0443x45)}{2(2 - .0443)} = 5.23$$

$$Q_{R_2} = \frac{.75x30 - .0443x45}{2(2 - .0443)1} = 5.23$$

Panel 3

$$-Q_C = \frac{(.0507 - 1)(.0482x37.5 + .25x30)}{2(2 - .0482)1} = -2.36$$

$$-Q_D = \frac{(-.25x30 - .0482x37.5)}{2(2 - .0482)} = -2.38$$

$$Q_{R_3} = \frac{-.25x30 - .0482x37.5}{2(2 - .0482)1} = -2.38$$

Panel 4

$$-Q_D = \frac{-1(.25x30)}{4} = -1.87$$

$$-Q_E = \frac{-.25x30}{4} = -1.87$$

$$Q_{R_4} = \frac{-.25x30}{4} = -1.87$$

Panel 5

$-Q_E = -1.88$

$-Q_F = -1.88$

$Q_{R_5} = -1.88$

Panel 6

$-Q_F = -1.64$

$-Q_G = -1.56$

$Q_{R_6} = -1.64$

Panel 7

$-Q_G = -1.74$

$-Q_H = -1.66$

$Q_{R_7} = -1.74$

Panel 8

$-Q_H = -1.80$

$-Q_I = -1.62$

$Q_{R_8} = -1.80$

Load at D

Panel 1

$$-Q_A = \frac{(.0942 - 1)(.0866x18.75 - .625x30)}{2(2 - .0866)1} = 4.12$$

$$-Q_B = \frac{.625x30 - .0866x18.75}{2(2 - .0866)} = 4.49$$

$$Q_{R_1} = \frac{.625x30 - .0866x18.75}{2(2 - .0866)1} = 4.49$$

Panel 2

$$-Q_B = \frac{(.0463 - 1)(.0443x37.5 - .625x30)}{2(2 - .0443)1} = 4.14$$

$$-Q_C = \frac{(.625x30 - .0443x37.5)}{2(2 - .0443)} = 4.36$$

$$Q_{R_2} = \frac{.625x30 - .0443x37.5}{2(2 - .0443)1} = 4.36$$

Panel 3

$$-Q_C = \frac{(.0507 - 1)(.0482x56.25 - .625x30)}{2(2 - .0482)1} = 3.91$$

$$-Q_D = \frac{.625x30 - .0482x56.25}{2(2 - .0482)} = 4.12$$

$$Q_{R_3} = \frac{.625x30 - .0482x56.25}{2(2 - .0482)} = 4.12$$

Panel 4

$$-Q_D = \frac{-1(.375x30)}{4} = -2.82$$

$$-Q_E = \frac{(-.375x30)}{4} = -2.82$$

$$Q_{R_4} = \frac{-.375x30}{4} = -2.82$$

Panel 5

$-Q_E = -2.82$

$-Q_F = -2.82$

$Q_{R_5} = -2.82$

Panel 6

$-Q_F = -2.46$

$-Q_G = -2.34$

$Q_{R_6} = -2.46$

Panel 7

$-Q_G = -2.61$

$-Q_H = -2.49$

$Q_{R_7} = -2.61$

Panel 8

$-Q_H = -2.70$

$-Q_I = -2.43$

$Q_{R_8} = -2.70$

Load at E

Panel 1

$$-Q_A = \frac{(.0942 - 1)(.0866x15 - .5x30)}{2(2 - .0866)1} = 3.26$$

$$-Q_B = \frac{.5x30 - .0866x15}{2(2 - .0866)} = 3.59$$

$$Q_{R_1} = \frac{.5x30 - .0866x15}{2(2 - .0866)1} = 3.59$$

Panel 2

$$-Q_B = \frac{(.0463 - 1)(.0443x30 - .5x30)}{2(2 - .0443)1} = 3.31$$

$$-Q_C = \frac{(.5x30 - .0443x30)}{2(2 - .0443)} = 3.49$$

$$Q_{R_2} = \frac{.5x30 - .0443x30}{2(2 - .0443)1} = 3.49$$

Panel 3

$$-Q_C = \frac{(.0507 - 1)(.0482x45 - .5x30)}{2(2 - .0482)1} = 3.13$$

$$-Q_D = \frac{(.5x30 - .0482x45)}{2(2 - .0482)} = 3.30$$

$$Q_{R_3} = \frac{.5x30 - .0482x45}{2(2 - .0482)1} = 3.30$$

Panel 4

$$-Q_D = \frac{-1(-.5x30)}{4} = 3.75$$

$$-Q_E = \frac{(.5x30)}{4} = 3.75$$

$$Q_{R_4} = \frac{.5x30}{4} = 3.75$$

Panel 5

$-Q_E = -3.76$

$-Q_F = -3.76$

$Q_{R_5} = -3.76$

Panel 6

$-Q_F = -3.28$

$-Q_G = -3.12$

$Q_{R_6} = -3.28$

Panel 7

$-Q_G = -3.48$

$-Q_H = -3.32$

$Q_{R_7} = -3.48$

Panel 8

$-Q_H = -3.60$

$-Q_I = -3.24$

$Q_{R_8} = -3.60$

Equations for Determining Joint Constants

Panel 1

$$\left[1.5\times1 + 1 + \frac{(3 - .0866)(.0942\times1 - 1)}{2(2 - .0866)}\right] A$$

$$+ \left[\tfrac{1}{2} + \frac{(3 - 2\times.0866)(.0942\times1 - 1)}{2(2 - .0866)}\right] B = -Q_A$$

$$1.82A - .17B = -Q_A$$

$$\left[1 + 1.5\times1 - \frac{(3 - 2\times.0866)1}{2(2 - .0866)}\right] B + \left[\tfrac{1}{2} - \frac{(3 - .0866)1}{2(2 - .0866)}\right] A = -Q_B$$

$$1.76B - .26A = -Q_B$$

Panel 2

$$\left[1.5\times1 + 1 + \frac{(3 - .0443)(.0463\times1 - 1)}{2(2 - .0443)}\right] B$$

$$+ \left[\tfrac{1}{2} \quad \frac{(3 - 2\times.0443)(.0463\times1 - 1)}{2(2 - .0443)}\right] C = -Q_B$$

$$1.78B - .21C = -Q_B$$

$$\left[1 + 1.5\times1 - \frac{(3 - 2\times.0443)1}{2(2 - .0443)}\right] C$$

$$+ \left[\tfrac{1}{2} + \frac{(3 - .0443)1}{2(2 - .0443)}\right] B = -Q_C$$

$$1.76C - .26B = -Q_C$$

Panel 3

$$\left[1.5\text{x}1 + 1 + \frac{(3 - .0482)(.0507\text{x}1 - 1)}{2(2 - .0482)}\right] C$$

$$+ \left[\tfrac{1}{2} + \frac{(3 - 2\text{x}.0482)(.0507\text{x}1 - 1)}{2(2 - .0482)}\right] D = -Q_C$$

$$1.78C - .21D = -Q_C$$

$$\left[1 + 1.5\text{x}1 - \frac{(3 - 2\text{x}.0482)\text{x}1}{2(2 - .0482)}\right] D$$

$$+ \left[\tfrac{1}{2} - \frac{(3 - .0482)\text{x}1}{2(2 - .0482)}\right] C = -Q_D$$

$$1.76D - .26C = -Q_D$$

Panel 4

$$\left[1.5\text{x}1 + \tfrac{1}{4}\right] D - \tfrac{1}{4}E = -Q_D$$

$$1.75D - .25E = -Q_D$$

$$\left[1.5\text{x}1 + \tfrac{1}{4}\right] E - \tfrac{1}{4}D = -Q_E$$

$$1.75E - .25D = -Q_E$$

Joint Constant Computation - Load at B

Panel 1

$$1.82A - .17B = 5.77$$
$$-.26A + 1.76B = 6.28$$
$$A = 3.56 \quad B = 4.09$$

$$R_1 = \frac{2.91x3.56 + 2.83x4.09}{3.82} + 6.28 = 12.03$$

$$M_{AB} = (3.56 + \frac{4.09}{2} - 12.03) = -6.43$$

$$M_{BA} = (4.09 + \frac{3.56}{2} - 12.03) = -6.16$$

Panel 2

$$1.78B - .21C = -1.15$$
$$-.26B + 1.76C = -1.21$$
$$B = -.74 \quad C = -.80$$

$$R_2 = \frac{-2.96x.74 - 2.91x.80}{3.92} - 1.21 = -2.36$$

$$M_{BC} = (-.74 - \frac{.80}{2} + 2.36) = 1.22$$

$$M_{CB} = (-.80 - \frac{.74}{2} + 2.36) = 1.19$$

Panel 3

$$1.78C - .21D = -1.13$$
$$-.26C + 1.76D = -1.19$$
$$C = -.73 \quad D = -.78$$

$$R_3 = \frac{-2.95x.73 - 2.90x.78}{3.90} - 1.19 = -2.33$$

$$M_{CD} = (-.73 - \frac{.78}{2} + 2.33) = 1.21$$

$$M_{DC} = (-.78 - \frac{.73}{2} + 2.33) = 1.19$$

Panel 4

$$1.75D - .25E = -.94$$
$$-.25D + 1.75E = -.94$$
$$D = -.63 \quad E = -.63$$

$$R_4 = \frac{3}{4}(-.63 - .63) - .94 = -1.88$$

$$M_{DE} = (-.63 - \frac{.63}{2} + 1.88) = .94$$

$$M_{ED} = (-.63 - \frac{.63}{2} + 1.88) = .94$$

Panel 5

$$1.75E - .25F = -0.94$$
$$-.25E + 1.75F = -0.94$$
$$E = -0.63 \quad F = -0.63$$

$$R_5 = 3/4(-0.63 - 0.63) - 0.94 = -1.88$$

$$M_{EF} = 1(-0.63 - \tfrac{1}{2}x0.63 + 1.88) = .94$$

$$M_{FE} = 1(-0.63 - \tfrac{1}{2}x0.63 + 1.88) = .94$$

Panel 6

$$1.76F - .26G = -0.82$$
$$-.21F + 1.78G = -0.78$$
$$F = -0.54 \quad G = -0.50$$

$$R_6 = \frac{-2.90x.54 - 2.95x.50}{3.90} - .82 = -1.60$$

$$M_{FG} = 1(-0.54 - \tfrac{1}{2}x0.50 + 1.60) = 0.81$$

$$M_{GF} = 1(-0.50 - \tfrac{1}{2}x0.54 + 1.60) = 0.83$$

Panel 7

$$1.76G - .26H = -0.87$$
$$-.20G + 1.78H = -0.83$$
$$G = -0.57 \quad H = -0.53$$

$$R_7 = \frac{-2.91x.57 - 2.96x0.53}{3.91} - 0.87 = 1.70$$

$$M_{GH} = 1(-0.57 - \tfrac{1}{2}x0.53 + 1.70) = .87$$

$$M_{HG} = 1(-0.53 - \tfrac{1}{2}x0.57 + 1.70) = .89$$

Panel 8

$$1.76H - .26I = -0.90$$
$$-.17H + 1.82I = -0.81$$
$$H = -0.59 \quad I = -0.50$$

$$R_8 = \frac{-2.83x.59 - 2.91x.50}{3.83} - 0.90 = -1.71$$

$$M_{HI} = 1(-0.59 - \tfrac{1}{2}x0.50 + 1.71) = 0.87$$

$$M_{IH} = 1(-0.50 - \tfrac{1}{2}x0.59 + 1.71) = 0.93$$

Panel 5
$$1.75E - .25F = -0.94$$
$$-.25E + 1.75F = -0.94$$
$$E = -0.63 \quad F = -0.63$$

$$R_5 = 3/4(-0.63 - 0.63) - 0.94 = -1.88$$

$$M_{EF} = 1(-0.63 - \tfrac{1}{2}x0.63 + 1.88) = .94$$

$$M_{FE} \doteq 1(-0.63 - \tfrac{1}{2}x0.63 + 1.88) = .94$$

Panel 6
$$1.76F - .26G = -0.82$$
$$-.21F + 1.78G = -0.78$$
$$F = -0.54 \quad G = -0.50$$

$$R_6 = \frac{-2.90x.54 - 2.95x.50}{3.90} - .82 = -1.60$$

$$M_{FG} = 1(-0.54 - \tfrac{1}{2}x0.50 + 1.60) = 0.81$$

$$M_{GF} = 1(-0.50 - \tfrac{1}{2}x0.54 + 1.60) = 0.83$$

Panel 7
$$1.76G - .26H = -0.87$$
$$-.20G + 1.78H = -0.83$$
$$G = -0.57 \quad H = -0.53$$

$$R_7 = \frac{-2.91x.57 - 2.96x0.53}{3.91} - 0.87 = 1.70$$

$$M_{GH} = 1(-0.57 - \tfrac{1}{2}x0.53 + 1.70) = .87$$

$$M_{HG} = 1(-0.53 - \tfrac{1}{2}x0.57 + 1.70) = .89$$

Panel 8
$$1.76H - .26I = -0.90$$
$$-.17H + 1.82I = -0.81$$
$$H = -0.59 \quad I = -0.50$$

$$R_8 = \frac{-2.83x.59 - 2.91x.50}{3.83} - 0.90 = -1.71$$

$$M_{HI} = 1(-0.59 - \tfrac{1}{2}x0.50 + 1.71) = 0.87$$

$$M_{IH} = 1(-0.50 - \tfrac{1}{2}x0.59 + 1.71) = 0.93$$

Joint Constant Computations - Load at C

Panel 1

$$1.82A - .17B = 4.89$$
$$-.26A + 1.76B = 5.38$$
$$A = 3.01 \qquad B = 3.50$$

$$R_1 = \frac{2.91x3.01 + 2.83x3.50}{3.82} + 5.38 = 10.27$$

$$M_{AB} = (3.01 + \frac{3.50}{2} - 10.27) = -5.51$$

$$M_{BA} = (3.50 + \frac{3.01}{2} - 10.27) = -5.27$$

Panel 2

$$1.78B - .21C = 4.96$$
$$-.26B + 1.76C = 5.23$$
$$B = 3.20 \qquad C = 3.44$$

$$R_2 = \frac{2.96x3.20 + 2.91x3.44}{3.92} + 5.23 = 10.21$$

$$M_{BC} = (3.20 + \frac{3.44}{2} - 10.21) = -5.29$$

$$M_{CB} = (3.44 + \frac{3.20}{2} - 10.21) = -5.17$$

Panel 3

$$1.78C - .21D = -2.36$$
$$-.26C + 1.76D = -2.38$$
$$C = -1.51 \qquad D = -1.58$$

$$R_3 = \frac{-2.95x1.51 - 2.90x1.58}{3.90} - 2.38 = -4.70$$

$$M_{CD} = (-1.51 - \frac{1.58}{2} + 4.70) = 2.40$$

$$M_{DC} = (-1.58 - \frac{1.51}{2} + 4.70) = 2.37$$

Panel 4

$$1.75D - .25E = -1.87$$
$$-.26D + 1.75E = -1.87$$
$$D = -1.25 \qquad E = -1.25$$

$$R_4 = 3/4(-1.25 \cdot 1.25) - 1.87 = -3.74$$

$$M_{DE} = (-1.25 - \frac{1.25}{2} + 3.74) = 1.87$$

$$M_{ED} = (-1.25 - \frac{1.25}{2} + 3.74) = 1.87$$

Panel 5

$E = -1.26$

$F = -1.26$

$R_5 = -3.76$

$M_{EF} = 1.88$

$M_{FE} = 1.88$

Panel 6

$F = -1.08$

$G = -1.00$

$R_6 = -3.20$

$M_{FG} = 1.62$

$M_{GF} = 1.66$

Panel 7

$G = -1.14$

$H = -1.06$

$R_7 = -3.40$

$M_{GH} = 1.74$

$M_{HG} = 1.78$

Panel 8

$H = -1.18$

$I = -1.00$

$R_8 = -3.42$

$M_{HI} = 1.74$

$M_{IH} = 1.86$

Joint Constant Computation-Load at D

Panel 1

$$1.82A - .17B = 4.12$$
$$-.26A + 1.76B = 4.49$$
$$A = 2.54 \quad B = 2.92$$

$$R_1 = \frac{2.91 \times 2.54 + 2.83 \times 2.92}{3.82} + 4.49 = 8.59$$

$$M_{AB} = (2.54 + \frac{2.92}{2} - 8.59) = -4.59$$

$$M_{BA} = (2.92 + \frac{2.54}{2} - 8.59) = -4.50$$

Panel 2

$$1.78B - .21C = 4.14$$
$$-.26B + 1.76C = 4.36$$

$$B = 2.67 \quad C = 2.87$$

$$R_2 = \frac{2.96 \times 2.67 + 2.91 \times 2.87}{3.92} + 4.36 = 8.51$$

$$M_{BC} = (2.67 + \frac{2.87}{2} - 8.51) = -4.41$$

$$M_{CB} = (2.87 + \frac{2.67}{2} - 8.51) = -4.31$$

Panel 3

$$1.78C - .21D = 3.91$$
$$-.26C + 1.76D = 4.12$$

$$C = 2.52 \quad D = 2.71$$

$$R_3 = \frac{2.95 \times 2.52 + 2.90 \times 2.71}{3.90} + 4.12 = 8.04$$

$$M_{CD} = (2.52 + \frac{2.71}{2} - 8.04) = -4.17$$

$$M_{DC} = (2.71 + \frac{2.52}{2} - 8.04) = 4.07$$

Panel 4

$$1.75D - .25E = -2.82$$
$$-.25D + 1.75E = -2.82$$

$$D = -1.88 \quad E = -1.88$$

$$R_4 = \frac{3}{4}(-1.88 - 1.88) - 2.82 = -5.64$$

$$M_{DE} = (-1.88 - \frac{1.88}{2} + 5.64) = 2.82$$

$$M_{ED} = (-1.88 - \frac{1.88}{2} + 5.64) = 2.82$$

Panel 5

$E = -1.89$

$F = -1.89$

$R_5 = -5.64$

$M_{EF} = 2.82$

$M_{FE} = 2.82$

Panel 6

$F = -1.62$

$G = -1.50$

$R_6 = 4.80$

$M_{FG} = 2.43$

$M_{GF} = 2.49$

Panel 7

$G = -1.71$

$H = -1.59$

$R_7 = -5.10$

$M_{GH} = 2.61$

$M_{HG} = 2.67$

Panel 8

$H = -1.77$

$I = -1.50$

$R_8 = -5.13$

$M_{HI} = 2.61$

$M_{IH} = 2.79$

Joint Constant Computation - Load at E

Panel 1

$$1.82A - .17B = 3.26$$

$$-.26A + 1.76B = 3.59$$

$$A = 2.01 \qquad B = 2.34$$

$$R_1 = \frac{2.91x2.01 + 2.83x2.34}{3.82} + 3.59 = 6.86$$

$$M_{AB} = (2.01 + \frac{2.34}{2} - 6.86) = -3.68$$

$$M_{BA} = (2.34 + \frac{2.01}{2} - 6.86) = -3.52$$

Panel 2

$$1.78B - .21C = 3.31$$

$$-.26B + 1.76C = 3.49$$

$$B = 2.13 \qquad C = 2.30$$

$$R_2 = \frac{2.96x2.13 + 2.91x2.30}{3.92} + 3.49 = 6.81$$

$$M_{BC} = (2.13 + \frac{2.30}{2} - 6.81) = -3.53$$

$$M_{CB} = (2.30 + \frac{2.13}{2} - 6.81) = -3.45$$

Panel 3

$$1.78C - .21D = 3.13$$

$$-.26C + 1.76D = 3.30$$

$$C = 2.01 \qquad D = 2.17$$

$$R_3 = \frac{2.95x2.01 + 2.90x2.17}{3.90} + 3.30 = 6.44$$

$$M_{CD} = (2.01 + \frac{2.17}{2} - 6.44) = -3.35$$

$$M_{DC} = (2.17 + \frac{2.01}{2} - 6.44) = -3.27$$

Panel 4

$$1.75D - .25E = 3.75$$

$$-.25D + 1.75E = 3.75$$

$$D = 2.50 \qquad E = 2.50$$

$$R_4 = 3/4(2.50 + 2.50) + 3.75 = 7.50$$

$$M_{DE} = (2.50 + \frac{2.50}{2} - 7.50) = -3.75$$

$$M_{ED} = (2.50 + \frac{2.50}{2} - 7.50) = -3.75$$

Panel 5

$E = -2.52$

$F = -2.52$

$R_5 = -7.52$

$M_{EF} = 3.76$

$M_{FE} = 3.76$

Panel 6

$F = -2.16$

$G = -2.00$

$R_6 = -6.40$

$M_{FG} = 3.24$

$M_{GF} = 3.24$

Panel 7

$G = -2.28$

$H = -2.12$

$R_7 = -6.80$

$M_{GH} = 3.48$

$M_{HG} = 3.56$

Panel 8

$H = -2.$[illegible]6

$I = -2.$[illegible]

$R_8 = -6.$[illegible]

$M_{HI} = 3.48$

$M_{IH} = 3.72$

Moment Corrections - Load at PP1

Panel 1

$$1.82A - .17B = 0$$
$$-.26A + 1.76B = -1.22$$
$$A = -.07 \qquad B = -.69$$

$$R_1 = \frac{-2.91x.07 - 2.83x.69}{3.83} = -.54$$

$$M_{AB} = 1(-.07 - \tfrac{1}{2}x.69 + .54) = .12$$

$$M_{BA} = 1(-.69 - \tfrac{1}{2}x.07 + .54) = -.18$$

Panel 2

$$1.78B - .20C = 6.16$$
$$-.26B + 1.76C = -1.21$$
$$B = 3.44 \qquad C = -.18$$

$$R_2 = \frac{2.96x3.44 - 2.91x.18}{3.91} = 2.47$$

$$M_{BC} = 1(3.44 - \tfrac{1}{2}x.18 - 2.47) = .88$$

$$M_{CB} = 1(-.18 + \tfrac{1}{2}x3.44 - 2.47) = -.93$$

Panel 3

$$1.78C - .21D = -1.19$$
$$-.26C + 1.76D = -.94$$
$$C = -.74 \qquad D = -.64$$

$$R_3 = \frac{-2.95x.74 - 2.90x.64}{3.90} = -1.04$$

$$M_{CD} = 1(-.74 - \tfrac{1}{2}x.64 + 1.04) = -.02$$

$$M_{DC} = 1(-.64 - \tfrac{1}{2}x.74 + 1.04) = .03$$

Panel 4

$$1.75D - .25E = -1.19$$
$$-.25D + 1.75E = -.94$$
$$D = -.77 \qquad E = -.64$$

$$R_4 = 3/4(-.77 - .64) = -1.06$$

$$M_{DE} = 1(-.77 - \tfrac{1}{2}x.64 + 1.06) = -.03$$

$$M_{ED} = 1(-.64 - \tfrac{1}{2}x.77 + 1.06) = .03$$

Panel 5

$$1.75E - .25F = -.94$$
$$-.25E + 1.75F = -.81$$

$$E = -.61$$

$$F = -.54$$

$$R_5 = \frac{3}{4}(-.61 - .54) = -.86$$

$$M_{EF} = 1(-.61 - \frac{1}{2} x.54 + .86) = -.02$$

$$M_{FE} = 1(-.54 - \frac{1}{2} x.61 + .86) = .02$$

Panel 6

$$1.76F - .26G = -.94$$
$$-.21F + 1.78G = -.93$$

$$F = -.62$$

$$G = -.56$$

$$R_6 = \frac{-2.90 x.62 - 2.95 x.56}{3.90} = -.88$$

$$M_{FG} = 1(-.62 - \frac{1}{2} x.56 + .88) = 0$$

$$M_{GF} = 1(-.56 - \frac{1}{2} x/62 + .88) = 0$$

Panel 7

$$1.76G - .26H = -.83$$
$$-.20G + 1.78H = -.87$$

$$G = -.55$$

$$H = -.55$$

$$R_7 = \frac{-2.91 x.55 - 2.96 x.55}{3.91} = -.83$$

$$M_{GH} = 1(-.55 - \frac{1}{2} x.55 + .83) = 0$$

$$M_{HG} = 1(-.55 - \frac{1}{2} x.55 + .83) = 0$$

Panel 8

$$1.76H - .26I = -.89$$
$$-.17H + 1.82I = 0$$

$$H = -.51$$
$$I = -.05$$

$$R_8 = \frac{-2.83 x.51 - 2.91 x.05}{3.83} = -.41$$

$$M_{HI} = 1(-.51 - \frac{1}{2} x.05 + .42) = -.11$$

$$M_{IH} = 1(-.05 - \frac{1}{2} x.51 + .42) = .11$$

Panel 1

$$1.82A - .17B = 0$$

$$-.26A + 1.76 = -.88$$

$$A = -.04$$

$$B = -.49$$

$$R_1 = \frac{-2.91 \times .04 - 2.83 \times .49}{3.83} = -.40$$

$$M_{AB} = (.04 - \frac{1}{2} \times .49 + .40) = .11$$

$$M_{BA} = (.49 - \frac{1}{2} \times .04 + .40) = -.11$$

Panel 3

$$1.78C - .21D = .93$$

$$-.26C + 1.76D = .03$$

$$C = .59$$

$$D = .10$$

$$R_3 = \frac{2.95 \times .59 - 2.90 \times .10}{3.90} = .52$$

$$M_{CD} = 1(.59 + \frac{1}{2} \times .10 - .52) = .12$$

$$M_{DC} = 1(.10 + \frac{1}{2} \times .59 - .52) = -.12$$

Lead at B

nel	1		2		3		4	
	A	B	B	C	C	D	D	E
Q	5.77	6.28	-1.15	-1.21	-1.13	-1.19	-.94	-.94
[illegible]	3.56	4.09	-.74	-.80	-.73	-.78	-.63	-.63
R	2.03		-2.36		-2.33		-1.88	
M'	-6.43	-6.16	1.22	1.19	1.21	1.19	0.94	0.94
Q	0	-1.22	6.16	-1.21	-1.19	-.94	-1.19	-.94
[illegible]	-.07	-.69	3.44	-.18	-.74	-.64	-.77	-.64
R	-.54		2.47		-1.04		-1.06	
M"	.12	-.18	.88	-.93	-.02	.03	-.03	.03
Q	0	-.88			-.93	.03		
[illegible]	-.04	-.49			.59	.10		
R	-.40				.52			
M"'	.11	-.11	0	0	.12	-.12	0	0
M	-6.20	-6.45	2.10	.26	1.31	1.10	.91	.97

nel	5		6		7		8	
	E	F	F	G	G	H	H	I
Q	-.94	-.94	-.82	-.78	-.87	-.83	-.90	-.81
	-.63	-.63	-.54	-.50	-.57	-.53	-.59	-.50
R	-1.88		-1.60		-1.70		-1.71	
M'	.94	.94	.81	.83	.87	.89	.87	.93
Q	-.94	-.81	-.94	-.87	-.83	-.87	-.89	0
	-.61	-.54	-.62	-.56	-.55	-.55	-.51	-.05
R	-.86		-.88		-.83		-.41	
M"	-.02	.02	0	0	0	0	-.11	.11
Q								
R								
M"'	0	0	0	0	0	0	0	0
M	.92	.96	.81	.83	.87	.89	.76	1.04

Moment Corrections Load at C

Panel 1

$$1.82A - .17B = 0$$

$$-.26A + 1.76B = 5.29$$

$$A = .29$$

$$B = 3.04$$

$$R_1 = \frac{2.91 \times .29 + 2.83 \times 3.04}{3.83} = 2.46$$

$$M_{AB} = 1(.29 + \frac{1}{2} \times 3.04 - 2.46) = -.65$$

$$M_{BC} = 1(3.04 + \frac{1}{2} \times .29 - 2.46) = .72$$

Panel 2

$$1.78B - .20C = 5.27$$

$$-.26B + 1.76\,C = -2.40$$

$$B = 2.85$$

$$C = -.94$$

$$R_2 = \frac{2.96 \times 2.85 - 2.91 \times .94}{3.91} = 1.46$$

$$M_{BC} = 1(2.85 - \frac{1}{2} \times .94 - 1.46) = .92$$

$$M_{CB} = 1(-.94 + \frac{1}{2} \times 2.85 - 1.46) = -.98$$

Panel 3

$$1.78C - .21D = 5.17$$

$$-.26C + 1.76D = -1.87$$

$$C = 2.82$$

$$D = -.65$$

$$R_3 = \frac{2.95 \times 2.82 - 2.90 \times .65}{3.90} = 1.65$$

$$M_{CD} = 1(2.82 - \frac{1}{2} \times .65 - 1.65) = .85$$

$$M_{DC} = 1(-.65 + \frac{1}{2} \times 2.82 - 1.65) = -.89$$

nel 4

$$1.75D - .25E = -2.37$$

$$-.25D + 1.75E = -1.88$$

$$D = -1.54$$

$$E = -1.30$$

$$R_4 = \frac{3}{4}(-1.54 - 1.30) = -2.13$$

$$M_{DE} = 1(-1.54 - \frac{1}{2} \times 1.30 + 2.13) = -.06$$

$$M_{ED} = 1(-1.30 - \frac{1}{2} \times 1.54 + 2.13) = .06$$

anel 5

$$1.75 - .25F = -1.87$$

$$-.25E + 1.75F = -1.62$$

$$E = -1.23$$

$$F = -1.10$$

$$R_5 = \frac{3}{4}(-1.23 - 1.10) = -1.75$$

$$M_{EF} = 1(-1.23 - \frac{1}{2} \times 1.10 + 1.75) = -.03$$

$$M_{FE} = 1(-1.10 - \frac{1}{2} \times ;/23 + 1.75) = .03$$

anel 6

$$1.76F - .26G = -1.88$$

$$-.21F + 1.78G = -1.74$$

$$F = -1.22$$

$$G = -1.12$$

$$R_6 = \frac{-2.90 \times 1.22 - 2.95 \times 1.12}{3.90} = -1.75$$

$$M_{FG} = 1(-1.22 - \frac{1}{2} \times 1.12 + 1.75) = -.03$$

$$M_{GF} = 1(-1.12 - \frac{1}{2} \times 1.22 + 1.75) = .02$$

Panel 7

$$1.76G - .26H = -1.66$$

$$-.20G + 1.78H = -1.74$$

$$G = -1.10$$

$$H = -1.10$$

$$R_7 = \frac{-2.91x1.10 - 2.96x1.10}{3.91} = -1.65$$

$$M_{GH} = 1(-1.10 - \tfrac{1}{2}x1.10 + 1.65) = 0$$

$$M_{HG} = 1(-1.10 - \tfrac{1}{2}x1.10 + 1.65) = 0$$

Panel 8

$$1.76H - .26I = -1.78$$

$$-.17H + 1.82I = 0$$

$$H = -1.02$$

$$I = -0.10$$

$$R_8 = \frac{-2.83x1.02 - 2.91x.10}{3.83} = -.83$$

$$M_{HI} = 1(-1.02 - \tfrac{1}{2}x.10 + .83) = -.24$$

$$M_{IH} = 1(-.10 - \tfrac{1}{2}x1.02 + .83) = .22$$

Panel 1 $1.82A - .17B = 0$

$-.26A + 1.76B = -.92$

$A = -.05 \quad B = -.53$

$$R_1 = \frac{-2.91x.05 - 2.83x.53}{3.83} = -.43$$

$M_{AB} = 1(-.05 - \frac{1}{2}x.53 + .43) = .11$

$M_{BA} = 1(-.53 - \frac{1}{2}x.05 + .43) = -.11$

Panel 2 $1.78B - .20C = -.72$

$-.26B + 1.76C = -.85$

$B = -.46 \quad C = -.55$

$$R_2 = \frac{-2.96x.46 - 2.91x.55}{3.91} = -.76$$

$M_{BC} = 1(-.46 - \frac{1}{2}x.55 + .76) = .02$

$M_{CB} = 1(-.55 - \frac{1}{2}x.46 + .76) = -.02$

Panel 3 $1.78C - .21D = .98$

$-.26C + 1.76D = .06$

$C = .56 \quad D = .12$

$$R_3 = \frac{2.95x.56 + 2.90x.12}{3.90} = .57$$

$M_{CD} = 1(.56 + \frac{1}{2}x.12 - .51) = .11$

$M_{DC} = 1(.12 + \frac{1}{2}x.56 - .51) = -.11$

Panel 4 $1.75D - .25E = .89$

$-.25D + 1.75E = .03$

$D = .52 \quad E = .09$

$R_4 = 3/4(.52 + .09) = .46$

$M_{DE} = 1(.52 + \frac{1}{2}x.09 - .46) = .11$

$M_{ED} = 1(.09 + \frac{1}{2}x.52 - .46) = -.11$

Load at C

Panel	1		2		3		4	
Joint	A	B	B	C	C	D	D	E
Q	4.89	5.38	4.96	5.23	-2.36	-2.38	-1.87	-1.87
α	3.01	3.50	3.20	3.44	-1.51	-1.58	-1.25	-1.25
R	10.27		10.21		-4.70		-3.74	
M'	-5.41	-5.27	-5.29	-5.17	2.40	2.37	1.87	1.87
Q	0	5.29	5.27	-2.40	5.17	-1.87	-2.37	-1.88
α	.29	3.04	2.85	- .94	2.82	- .65	-1.54	-1.30
R	2.46		1.46		1.65		-2.13	
M'	- .65	.72	.92	- .98	.85	- .89	- .06	.06
Q	0	- .92	- .72	- .85	.98	.06	.89	.03
α	- .05	- .53	- .46	- .55	.56	.12	.52	.09
R	- .43		- .76		.51		.46	
M''	.11	- .11	.02	- .02	.11	- .11	.11	- .11
M	-6.05	-4.65	-4.35	-6.17	3.36	1.37	1.92	1.82

5		6		7		8	
L	F	F	G	G	H	H	I
-1.88	-1.88	-1.64	-1.56	-1.74	-1.66	-1.80	-1.62
-1.26	-1.26	-1.08	-1.00	-1.14	-1.06	-1.18	-1.10
-3.76		-3.20		-3.40		-3.42	
1.88	1.88	1.62	1.66	1.74	1.78	1.74	1.86
-1.87	-1.62	-1.88	-1.74	-1.66	-1.74	-1.78	0
-1.23	-1.10	-1.22	-1.12	-1.10	-1.10	-1.02	- .10
-1.75		-1.75		-1.65		- .83	
- .03	.03	- .03	.02	0	0	- .24	.22
- .06	.03	- .03	0	- .02	.24	0	0
0	0	0	0	0	0	0	0
1.85	1.91	1.59	1.68	1.74	1.78	1.50	2.08

Influence Line Corrections - First Set

Panel 1

Load at D

$$1.82A - .17B = 0$$

$$-.26A + 1.76B = 4.41$$

$$A = .24$$
$$B = 2.54$$
$$R_1 = 2.06$$

$$M_{AB} = \left(.24 + \frac{2.54}{2} - 2.06\right) = -.57$$

$$M_{BA} = \left(2.54 + \frac{.24}{2} - 2.06\right) = -.59$$

Panel 2

$$1.78B - .21C = 4.40$$
$$-.26B + 1.76C = 4.17$$

$$B = 2.80$$
$$C = 2.78$$
$$R_2 = 4.18$$

$$M_{BC} = \left(2.80 + \frac{2.78}{2} - 4.18\right) = 0$$

$$M_{CB} = \left(2.78 + \frac{2.80}{2} - 4.18\right) = 0$$

Panel 3

$$1.78C - .21D = 4.31$$
$$-.26C + 1.76D = -2.82$$
$$C = 2.27$$
$$D = -1.27$$
$$R_3 = .78$$

$$M_{CD} = \left(2.27 - \frac{1.27}{2} - .78\right) = .86$$

$$M_{CD} = \left(-1.27 + \frac{2.27}{2} - .78\right) = -.92$$

Panel 4

$$1.75D - .25E = 4.07$$
$$-.25D + 1.75E = -2.82$$
$$D = 2.14$$
$$E = -1.30$$
$$R_4 = .63$$

$$M_{DE} = \left(2.14 - \frac{1.30}{2} - .63\right) = .86$$

$$M_{ED} = \left(-1.30 + \frac{2.14}{2} - .63\right) = -.86$$

Panel 5

$$-.25F + 1.75E = -2.82$$
$$1.75F - .25E = -2.43$$

$$E = -1.85$$
$$F = -1.65$$
$$R_5 = -2.63$$

$$M_{EF} = \left(-1.85 - \frac{1.65}{2} + 2.63\right) = -.04$$

$$M_{FE} = (-1.65 - 1.85 + 2.63) = .06$$

Panel 6

$$-.26G + 1.76F = -2.82$$
$$1.78G - .21F = -2.61$$

$$F = -1.85$$
$$G = -1.69$$
$$R_6 = -2.66$$

$$M_{FG} = \left(-1.85 - \frac{1.69}{2} + 2.66\right) = -.03$$

$$M_{GF} = \left(-1.69 - \frac{1.85}{2} + 2.66\right) = .05$$

Panel 7

$$-.26H + 1.76G = -2.49$$
$$1.78H - .21G = -2.61$$

$$G = -1.66$$
$$H = -1.66$$
$$R_7 = -2.49$$

$$M_{GH} = \left(-1.66 - \frac{1.66}{2} + 2.49\right) = 0$$

$$M_{HG} = \left(-1.66 - \frac{1.66}{2} + 2.49\right) = 0$$

Panel 8

$$-.26I + 1.76H = -2.67$$
$$1.82I - .17H = 0$$

$$H = -1.54$$
$$I = -.14$$
$$R_8 = -1.25$$

$$M_{HI} = \left(-1.54 - \frac{.14}{2} + 1.25\right) = -.36$$

$$M_{IH} = \left(-.14 - \frac{1.54}{2} + 1.25\right) = .34$$

Influence Line Corrections-Load at D

Second Set

nel 1 0

nel 2
$$1.78B - .21C = .59$$
$$-.26B + 1.76C = -.86$$

$$B = -.40$$
$$C = -.55$$
$$R_2 = -.71$$

$$M_{BC} = \left(-.40 - \frac{.55}{2} + .71\right) = .04$$

$$M_{CB} = \left(-.55 - \frac{.40}{2} + .71\right) = -.04$$

nel 3
$$1.78C - .21D = 0$$
$$-.26C + 1.76D = -.86$$

$$C = -.06$$
$$D = -.50$$
$$R_3 = -.42$$

$$M_{CD} = \left(-.06 - \frac{.50}{2} + .42\right) = .11$$

$$M_{DC} = \left(-.50 - \frac{.06}{2} + .42\right) = -.11$$

nel 4
$$1.75D - .25E = .92$$
$$-.25D + 1.75E = .04$$

$$D = .54$$
$$E = .10$$
$$R_4 = .48$$

$$M_{DE} = \left(.54 + \frac{.10}{2} - .48\right) = .11$$

$$M_{ED} = (.10 + .54 - .48) = .11$$

Panel 5
$$-.25F + 1.75E = .86$$
$$1.75F - .25E = .03$$

$$E = .50$$
$$F = .09$$
$$R_5 = .44$$

$$M_{EF} = \left(.50 + \frac{.09}{2} - .44\right) = .10$$

$$M_{FE} = \left(.09 + \frac{.50}{2} - .44\right) = -.10$$

Panel 6

$$-.26G + 1.76F = -.06$$

$$1.78G - .21F = 0$$

$$F = -.35 \qquad G = 0$$

$$M_{FG} = (-.35 - 0 + .26) = -.09$$

$$M_{GF} = (0 - .35 + .26) = .09$$

Panel 7

$$-.26H + 1.76G = -.03$$

$$1.78H - .21G = .36$$

$$G = .01 \qquad H = .20 \qquad R_7 = .16$$

$$M_{GH} = (.01 + \frac{.20}{2} - .16) = -.05$$

$$M_{HG} = (.20 + \frac{.01}{2} - .16) = .04$$

Panel 8 = 0

LOAD AT D

anel	1		2		3		4	
oint	A	B	B	C	C	D	D	E
-Q	4.12	4.49	4.14	4.36	3.91	4.12	2.82	-2.82
	2.54	2.92	2.67	2.87	2.52	2.71	-1.88	-1.88
R	8.59		8.51		8.04		-5.64	
M'	-4.59	-4.40	-4.41	-4.31	-4.17	-4.07	2.82	2.82
-Q	0	4.41	4.40	4.17	4.31	-2.82	4.07	-2.82
	.24	2.54	2.80	2.78	2.27	-1.27	2.14	-1.30
R	2.06		4.18		.78		.63	
M"	-.57	.59	0	0	.86	-.92	.86	-.86
-Q	0	0	-.59	-.86	0	-.86	.92	.04
			-.40	-.55	-.06	-.50	.54	.10
R			-.71		-.42		.48	
M"	0	0	.04	-.04	.11	-.11	.11	-.11
M	-5.16	-3.81	-4.37	-4.35	-3.20	-5.10	3.79	1.85

anel	5		6		7		8	
oint	E	F	F	G	G	H	H	I
-Q	-2.82	-2.82	-2.46	-2.34	-2.61	-2.49	-2.70	-2.43
[illegible]	-1.89	-1.82	-1.62	-1.50	-1.71	-1.59	-1.77	-1.50
R	-5.64		-4.80		-5.10		-5.13	
M'	2.82	2.82	2.43	2.49	2.61	2.67	2.61	2.79
-Q	-2.82	-2.43	-2.32	-2.61	-2.49	-2.61	-2.67	0
[illegible]	-1.85	-1.65	-1.69	-1.85	-1.66	-1.66	-1.54	-.14
R	-2.63		-2.66		-2.49		-1.25	
M"	-.04	.06	-.03	.05	0	0	-.36	.34
-Q	.86	.05	.06	0	-.03	.36	0	0
[illegible]	.50	.09	-.35	0	.01	.20		
R	.44		-.26		.15			
M"	.10	-.10	-.09	.09	-.05	.04	0	0
ΣM	2.88	2.78	2.33	2.61	2.56	2.71	2.25	3.13

Influence Line Corrections-Load at E
First Set

Panels 1,8

$$1.82A - .17B = 0$$

$$-.26A + 1.76B = 3.53$$

$A = -.19 \qquad B = 2.03 \qquad R_1 = 1.65$

$$M_{AB} = \left(.19 + \frac{2.03}{2} - 1.65\right) = -.45$$

$$M_{BA} = \left(2.03 + \frac{.19}{2} - 1.65\right) = .47$$

Panel 2,7

$$1.78B - .21C = 3.48$$

$$-.26B + 1.76C = 3.24$$

$B = 2.21 \qquad C = 2.17 \qquad R_2 = 3.28$

$$M_{BC} = \left(2.21 + \frac{2.17}{2} - 3.28\right) = .01$$

$$M_{CB} = \left(2.17 + \frac{2.21}{2} - 3.28\right) = -.01$$

Panels 3,6

$$1.78C - .21D = 3.45$$

$$-.26C + 1.76D = 3.76$$

$C = 2.23 \qquad D = 2.46 \qquad R_3 = 3.52$

$$M_{CD} = \left(2.23 + \frac{2.46}{2} - 3.52\right) = -.06$$

$$M_{DC} = \left(2.46 + \frac{2.23}{2} - 3.52\right) = .05$$

Panels 4,5

$$1.75D - .25E = 3.24$$

$$-.25D + 1.75E = -3.76$$

$D = 1.58 \qquad E = -1.92 \qquad R_4 = -.25$

$$M_{DE} = \left(1.53 - \frac{1.92}{2} + .25\right) = .87$$

$$M_{ED} = \left(-1.92 - \frac{1.58}{2} + .25\right) = -.88$$

Influence Line Corrections-Load at E
Second Set

Panels 1,8 0

Panels 2,7

$$1.78B - .21C = -.47$$

$$-.26B + 1.76C = .06$$

$B = -.26$ $C = -.01$ $R_2 = -.20$

$M_{BC} = (.01 - \frac{.26}{2} + .20) = .06$

$M_{CB} = (-.01 - .26 + 2.0) = .06$

Panels 3,6

$$1.75C - .21D = .01$$

$$-.26C + 1.76D = -.87$$

$C = -.05$ $D = -.50$ $R_3 = -.41$

$M_{CD} = (.05 - \frac{.50}{2} + .41 = .11$

$M_{DC} = (-.50 - \frac{.05}{2} + .41) = -.11$

Panels 4,5

$$1.75D - .25E = -.05$$

$$-.25D + 1.75E = -.88$$

$D = -.10$ $E = -.52$ $R_4 = -.46$

$M_{DE} = (-.10 - \frac{.52}{2} + .46) = .10$

$M_{ED} = (-.52 - \frac{.10}{2} + .46) = -.11$

Load at E

[illegible]nel	1		2		3		4	
[illegible]int	A	B	B	C	C	D	D	E
[illegible]	3.24	3.60	3.32	3.48	3.12	3.28	3.76	3.76
[illegible]	2.00	-2.36	2.12	2.28	2.00	2.16	2.52	2.52
[illegible]	6.84		6.81		6.40		7.52	
[illegible]	-3.72	-3.48	-3.53	-3.45	-3.24	-3.24	-3.76	-3.76
[illegible]	0	3.53	3.48	3.24	3.45	3.76	3.[illegible]4	-3.76
[illegible]	.19	2.03	2.[illegible]1	2.17	2.23	2.46	1.58	-1.92
[illegible]	1.65		3.28		3.52		-.25	
[illegible]	-.45	.47	.01	-.01	-.06	.05	.87	-.88
[illegible]	0	-.[illegible]1	-.47	.06	.01	-.87	-.05	-.88
[illegible]			-.26	-.01	-.05	-.50	-.10	-.52
[illegible]			-.20		-.41		-.46	
[illegible]			-.06	.06	.11	-.11	.10	-.11
[illegible]	-4.17	-3.01	-3.58	-3.40	-3.19	-3.30	-2.79	-4.75

Moment Computations

Member AA'	DL	=	3422 fk
	LL E-60	=	3005
	Impact	=	643
	Total		7070
	LL H15-S12-44	=	401
	Conc.	=	91
	Impact	=	68
	Total		560
	Sidewalk	=	239
	Design Moment	=	7,869 fk
Member BB'	DL	=	4680 fk
	LL-E60	=	3990
	Impact	=	835
	Total		9505
	LL H15-S12-44	=	548
	Conc.	=	128
	Impact	=	93
	Total		769
	Sidewalk	=	326
	Design Moment	=	10,600 fk
Member CC'	DL	=	3280 fk
	LL-E60	=	2945
	Impact	=	728
	Total		6953
	LL H15-S12-44	=	384
	Conc.	=	115
	Impact	=	82
	Total		581
	Sidewalk	=	247
	Design Moment	=	7,781 fk

nel	5		6		7		8	
int	E	F	F	G	G	H	H	I
-Q	-3.76	-3.76	-3.28	-3.12	-3.48	-3.32	-3.60	-3.24
[illegible]	-2.52	-2.52	-2.16	-2.00	-2.28	-2.12	-2.36	-2.00
R	-7.52		-6.40		-6.81		-6.84	
M'	3.76	3.76	3.24	3.24	3.45	3.53	3.48	3.72
-Q	3.76	-3.23	-3.76	-3.45	-3.24	-3.48	-3.53	0
[illegible]	1.92	-1.58	-2.46	-2.23	-2.17	-2.21	-2.03	-.19
R	.25		-3.52		-3.28		-1.65	
M"	.88	-.87	-.05	.06	.01	-.01	-.47	.45
Q	.88	.05	.87	-.01	-.06	.47	.01	0
[illegible]	.52	.10	.50	.05	.01	.26		
R	.46		.41		.20			
M"'	.11	-.10	.11	-.11	-.06	.06	0	0
M	4.75	2.79	3.30	3.19	3.40	3.58	3.01	4.17

Member DD'

DL	=	2132 fk
LL-E60	=	1950
Impact	=	536
Total	=	4618
LL-H15-S12-44	=	240
Conc.	=	88
Impact	=	53
Total	=	381
Sidewalk	=	171
Design Moment	=	5,170 fk

Member EE'

DL	=	1267 fk
LL-E60	=	1213
Impact	=	425
Total	=	2905
Sidewalk	=	114
Design Moment	=	3,282 fk

Member AB

DL	= 3422 fk
LL-E60	= 3005
Impact	= 643
Total	= 7070
LL-H15-S12-44	= 401
Conc.	= 91
Impact	= 68
Total	= 560
Sidewalk	= 239
Design Moment	= 7,689 fk

Member BC

DL	= 2326 fk
LL-E60	= 2092
Impact	= 481
Total	= 4849
LL-H15-S12-44	= 272
Conc.	= 75
Impact	= 52
Total	= 397
Sidewalk	= 169
Design Moment	= 5,465 fk

Member CD

DL	=	1666 fk
LL-H60	=	1551
Impact	=	398
Total	=	3615
LL-H15-S12-44	=	195
Conc.	=	64
Impact	=	44
Total	=	303
Sidewalk	=	125
Design Moment	=	4,043 fk

Member DE

DL	=	1192 fk
LL-H60	=	1150
Impact	=	345
Total	=	2687
LL-H15-S12-44	=	140
Conc.	=	56
Impact	=	37
Total	=	233
Sidewalk	=	100
Design Moment	=	3,020 fk

Influence Line Computations - Fourth Set

Load at B

Panel 1

$$-Q_A = \frac{(.0942 - 4)(.0866x26.25 - .875x30)}{2(2 - .0866)4} = 6.14$$

$$-Q_B = \frac{(.875x30 - .0866x26.25)}{2(2 - .0866)} = 6.28$$

$$Q_{R_1} = \frac{(.875x30 - .0866x26.25)}{2(2 - .0866)4} = 1.57$$

Panel 2

$$-Q_B = \frac{(.0463x1 - 4)(.0443x22.5 + .125x30)}{2(2 - .0443)4} = -1.20$$

$$-Q_C = \frac{(-.125x30 - 22.5x.0443)}{2(2 - .0443)} = -1.21$$

$$Q_{R_2} = \frac{(-.125x30 - 22.5x.0443)}{2(2 - .0443)4} = - .30$$

Panel 3

$$-Q_C = \frac{(.0507x2 - 3)(.0482x18.75 + .125x30)}{2(2 - .0482)3} = -1.16$$

$$-Q_D = \frac{(-.125x30 - .0482x18.75)}{2(2 - .0482)} = -1.19$$

$$Q_{R_3} = \frac{(-.125x30 - .0482x18.75)}{2(2 - .0482)3} = - .40$$

Panel 4

$$-Q_D = \frac{-2(.125x30)}{4x2} = -.94$$

$$-Q_E = \frac{(-.125x30)}{4} = -.94$$

$$Q_{R_4} = \frac{(-.125x30)}{4x2} = -.47$$

Panel 5

$$-Q_E = \frac{-.125x30}{4} = -0.94$$

$$-Q_F = \frac{-.125x30}{4} = -0.94$$

$$Q_{R_5} = \frac{-.125x30}{4x2} = -0.47$$

Panel 6

$$-Q_F = \frac{(-.125x30 + .0482x30)}{2(2 - .0482)} = -0.82$$

$$-Q_G = \frac{(.0507x2 - 3)(-.0482x11.25 + .125x30)}{2(2 - .0482)3} = -0.79$$

$$Q_{R_6} = \frac{(-.125x30 + .0482x11.25)}{2(2 - .0482)3} = -0.27$$

Panel 7

$$-Q_G = \frac{(-.125x30 + .0443x7.5)}{2(2 - .0443)} = -0.87$$

$$-Q_H = \frac{(.0463x1 - 4)(-.0443x7.5 + .125x30)}{2(2 - .0443)4} = -0.86$$

$$Q_{R_7} = \frac{(-.125x30 + .0443x7.5)}{2(2 - .0443)4} = -0.22$$

Panel 8

$$-Q_H = \frac{(-.125x30 + .0866x3.75)}{2(2 - .0866)} = -0.90$$

$$-Q_I = \frac{(.0942x1 - 4)(-.0866x3.75 + .125x30)}{2(2 - .0866)4} = -0.88$$

$$Q_{R_8} = \frac{(-.125x30 + .0866x3.75)}{2(2 - .0866)4} = -0.22$$

Load at C

Panel 1

$$-Q_A = \frac{(.0942x1 - 4)(.0866x22.5 - .75x30)}{2(2 - .0866)4} = 5.27$$

$$-Q_B = \frac{(.75x30 - .0866x22.5)}{2(2 - .0866)} = 5.38$$

$$Q_{R_1} = \frac{(.75x30 - .0866x22.5)}{2(2 - .0866)4} = 1.35$$

Panel 2

$$-Q_B = \frac{(.0463x1 - 4)(.0443x45 - .75x30)}{2(2 - .0443)4} = 5.17$$

$$-Q_C = \frac{(.75x30 - .0443x45)}{2(2 - .0443)} = 5.23$$

$$Q_{R_2} = \frac{(.75x30 - .0443x45)}{2(2 - .0443)4} = 1.31$$

Panel 3

$$-Q_C = \frac{(.0507x2 - 3)(.0482x37.5 + .25x30)}{2(2 - .0482)3} = -2.31$$

$$-Q_D = \frac{(-.25x30 - .0482x37.5)}{2(2 - .0482)} = -2.38$$

$$Q_{R_3} = \frac{(-.25x30 - .0482x37.5)}{2(2 - .0482)3} = - .79$$

Panel 4

$$-Q_D = \frac{-2(.25x30)}{4x2} = -1.87$$

$$-Q_E = \frac{(-.25x30)}{4} = -1.87$$

$$Q_{R_4} = \frac{-.25x30}{4x2} = -.94$$

Panel 5

$-Q_E = -1.88$

$-Q_F = -1.88$

$Q_{R_5} = -0.94$

Panel 6

$-Q_F = -1.64$

$-Q_G = -1.58$

$Q_{R_6} = -0.54$

Panel 7

$-Q_G = -1.74$

$-Q_H = -1.72$

$Q_{R_7} = -0.44$

Panel 8

$-Q_H = -1.80$

$-Q_I = -1.76$

$Q_{R_8} = -0.45$

Load at D

Panel 1

$$-Q_A = \frac{(.0942\text{x}1 - 4)(.0866\text{x}18.75 - .625\text{x}30)}{2(2 - .0866)4} = 4.38$$

$$-Q_B = \frac{(.625\text{x}30 - .0866\text{x}18.75)}{2(2 - .0866)} = 4.49$$

$$Q_{R_1} = \frac{(.625\text{x}30 - .0866\text{x}18.75)}{2(2 - .0866)4} = 1.12$$

Panel 2

$$-Q_B = \frac{(.0463\text{x}1 - 4)(.0443\text{x}37.5 - .625\text{x}30)}{2(2 - .0443)4} = 4.31$$

$$-Q_C = \frac{(.625\text{x}30 - .0443\text{x}37.5)}{2(2 - .0443)} = 4.36$$

$$Q_{R_2} = \frac{(.625\text{x}30 - .0443\text{x}37.5)}{2(2 - .0443)4} = 1.09$$

Panel 3

$$-Q_C = \frac{(.0507\text{x}2 - 3)(.0482\text{x}56.25 - .625\text{x}30)}{2(2 - .0482)3} = 3.98$$

$$-Q_D = \frac{(.625\text{x}30 - .0482\text{x}56.25)}{2(2 - .0482)} = 4.12$$

$$Q_{R_3} = \frac{(.625\text{x}30 - .0482\text{x}56.25)}{2(2 - .0482)3} = 1.37$$

Panel 4

$$-Q_D = \frac{-2(.375\text{x}30)}{4\text{x}2} = -2.82$$

$$-Q_E = \frac{(-.375\text{x}30)}{4} = -2.82$$

$$Q_{R_4} = \frac{(-.375\text{x}30)}{4\text{x}2} = -1.41$$

Panel 5

$-Q_E = -2.82$

$-Q_F = -2.82$

$Q_{R_5} = -1.41$

Panel 6

$-Q_F = -2.46$

$-Q_G = -2.37$

$Q_{R_6} = -0.81$

Panel 7

$-Q_G = -2.61$

$-Q_H = -2.58$

$Q_{R_7} = -0.66$

Panel 8

$-Q_H = -2.70$

$-Q_I = -2.64$

$Q_{R_8} = -0.67$

Load at E

Panel 1

$$-Q_A = \frac{(.0942x1 - 4)(.0866x15 - .5x30)}{2(2 - .0866)4} = 3.51$$

$$-Q_B = \frac{(.5x30 - .0866x15)}{2(2 - .0866)} = 3.59$$

$$Q_{R_1} = \frac{(.5x30 - .0866x15)}{2(2 - .0866)4} = .90$$

Panel 2

$$-Q_B = \frac{(.0463x1 - 4)(.0443x30 - .5x30)}{2(2 - .0443)4} = 3.44$$

$$-Q_C = \frac{(.5x30 - .0443x30)}{2(2 - .0443)} = 3.49$$

$$Q_{R_2} = \frac{(.5x30 - .0443x30)}{2(2 - .0443)4} = .87$$

Panel 3

$$-Q_C = \frac{(.0507x2 - 3)(.0482x45 - .5x30)}{2(2 - .0482)3} = 3.18$$

$$-Q_D = \frac{(.5x30 - .0482x45)}{2(2 - .0482)} = 3.30$$

$$Q_{R_3} = \frac{(.5x30 - .0482x45)}{2(2 - .0482)3} = 1.10$$

Panel 4

$$-Q_D = \frac{-2(-.5x30)}{4x2} = 3.75$$

$$-Q_E = \frac{(.5x30)}{4} = 3.75$$

$$Q_{R_4} = \frac{(.5x30)}{4x2} = 1.88$$

Panel 5

$-Q_E = -3.76$

$-Q_F = -3.76$

$Q_{R_5} = -1.88$

Panel 6

$-Q_F = -3.28$

$-Q_G = -3.16$

$Q_{R_6} = -1.08$

Panel 7

$-Q_G = -3.48$

$-Q_H = -3.44$

$Q_{R_7} = -0.88$

Panel 8

$-Q_H = -3.60$

$-Q_I = -3.52$

$Q_{R_8} = -0.90$

Determination of formulae for Panel Constant Computations

el 1

$$5 + 4 + \left[\frac{(3-.0866)(.0942 - 4)}{2(2-.0866)}\right]A + \left[2 + \frac{(3-.1732)(.0942 - 4)}{2(2-.0866)}\right]B = -Q_A$$

$$2.52A - .90B = -Q_A$$

$$1.5 - \left[\frac{(3-.1732)4}{2(2-.0866)}\right]B + \left[2 - \frac{(3-.0866)4}{2(2-.0866)}\right]A = -Q_B$$

$$2.54B - 1.04A = -Q_B$$

el 2

$$5 + 4 + \left[\frac{(3-.0443)(.0463 - 4)}{2(2-.0443)}\right]A + \left[2 + \frac{(3-.0886)(.0463 - 4)}{2(2-.0443)}\right]B = -Q_A$$

$$2.52A - .93B = -Q_A$$

$$+ 3 - \left[\frac{(3-.0886)4}{2(2-.0443)}\right]B + \left[2 - \frac{(3-.0443)4}{2(2-.0443)}\right]A = -Q_B$$

$$4.03B - 1.02A = -Q_B$$

nel 3

$$5x2 + 3 + \left[\frac{(3-.0482)(.0507x2-3)}{2(2-.0482)}\right]A + \left[1.5 + \frac{(3-.0946)(.0507x2-3)}{2(2-.0482)}\right]B = -Q_A$$

$$3.31A - .65B = -Q_A$$

$$+ 4.5 - \left[\frac{(3-.0946)3}{2(2-.0482)}\right]B + \left[1.5 - \frac{(3-.0482)3}{2(2-.0482)}\right]A = -Q_B$$

$$5.26B - .77A = -Q_B$$

nel 4

$$4.5 + 2 + \left[\frac{3(-2)}{4}\right]A + \left[1 + \frac{3(-2)}{4}\right]B = -Q_A$$

$$5.0A - .5B = -Q_A$$

$$2 + 6 - \left[\frac{3(2)}{4}\right]B + \left[1 - \frac{3(2)}{4}\right]A = -Q_B$$

$$6.5B - .5A = -Q_B$$

Panel 5

$$\left[1.5 \times 4 + \frac{2}{4}\right] E - \frac{2}{4} F = -Q_E$$

$$6.5E - 0.5F = -Q_E$$

$$\left[1.5 \times 3 + \frac{2}{4}\right] F - \frac{2}{4} E = -Q_F$$

$$5.0F - 0.5E = -Q_F$$

Panel 6

$$\left[3 + 1.5x3 - \frac{(3-2x.0482)3}{2(2-.0482)}\right] F + \left[\frac{3}{2} - \frac{(3-.0482(3}{2(2.0482)}\right] G = -Q_F$$

$$5.26F - 0.77G = -Q_F$$

$$2 + 3 + \frac{(3-.0482)(.0507x2-3)}{2(2-.0482)}\Bigg] G + \left[\frac{3}{2} + \frac{(3-2x.0482)(.0507x2-3)}{2(2.0482)}\right] F = -Q_G$$

$$3.81G - 0.65F = -Q_G$$

Panel 7

$$\left[4 + 1.5x2 - \frac{(3-2x.0443)4}{2(2-.0443)}\right] G + \left[\frac{4}{2} - \frac{(3-.0443)4}{2(2-.0443)}\right] H = -Q_G$$

$$4.03G - 1.02H = -Q_G$$

$$x1 + 4 + \frac{(3-.0443)(.0463x1-4)}{2(2-.0443)}\Bigg] H + \left[\frac{4}{2} + \frac{(3-2x.0443)(.0463x1-4)}{2(2-.0443)}\right] G = -Q_H$$

$$2.52H - 0.93G = -Q_H$$

Panel 8

$$\left[4 + 1.5x1 - \frac{(3-2x.-866)4}{2(2-.0866)}\right] H + \left[\frac{4}{2} - \frac{(3-.0866)4}{2(2.0866)}\right] I = -Q_H$$

$$2.54H - 1.040 = -Q_H$$

$$.5x1 + 4 + \frac{(3-.0866)(.0942x1-4)}{2(2-.0566)}\Bigg] I + \left[\frac{4}{2} - \frac{(3-2x.0866)(.0942x1-4)}{2(2-.0866)}\right] H = Q_I$$

$$2.52I - 0.90 = -Q_I$$

Joint Constant Computation - Load at B

Panel 1

$$2.52A - .90B = 6.14$$

$$-1.04A + 2.54B = 6.28$$

$$A = 3.89 \quad B = 4.07$$

$$R_1 = \frac{2.91x3.89 + 2.83x4.07}{3.82} + 1.57 = 7.45$$

$$M_{AB} = 4(3.89 + \frac{4.07}{2} - 7.45 = -6.12$$

$$M_{BA} = 4(4.07 + \frac{3.89}{2} - 7.45 = -5.80$$

Panel 2

$$2.52B - .93C = -1.20$$

$$-1.02B + 4.03C = -1.21$$

$$B = -.65 \quad C = -.46$$

$$R_2 = \frac{-2.96x.65 - 2.91x.46}{3.92} - .30 = -1.13$$

$$M_{BC} = 4(-.65 - \frac{.46}{2} + 1.13) = 1.00$$

$$M_{CB} = 4(-.46 - \frac{.65}{2} + 1.13) = 1.40$$

Panel 3

$$3.81C - .65D = -1.16$$

$$-.77C + 5.20D = -1.19$$

$$C = -.35 \quad D = -.28$$

$$R_3 = \frac{-2.95x.35 - 2.90x.28}{3.90} - .40 = -.87$$

$$M_{CD} = 3(-.35 - \frac{.28}{2} + .87) = 1.14$$

$$M_{DC} = 3(-.28 - \frac{.35}{2} + .87) = 1.26$$

Panel 4

$$5.0D - .5E = -.94$$

$$-.5D + 6.5E = -.94$$

$$D = -.20 \quad E = -.16$$

$$R_4 = 3/4(-.20 - .16) - .47 = -.74$$

$$M_{DE} = 2(-.20 - \frac{.16}{2} + .74) = .92$$

$$M_{ED} = 2(-.16 - \frac{.20}{2} + .74) = .96$$

anel 5

$$6.5E - 0.5F = -0.94$$

$$-0.5E + 5.0F = -0.94$$

$$E = -0.16$$
$$F = -0.20$$

$$R_5 = \frac{3}{4}(-.20 - .16) - 0.47 = -.74$$

$$M_{EF} = 2(-.16 - \frac{.20}{2} + .74) = .96$$

$$M_{FE} = 2(-.20 - \frac{.16}{2} + .74) = .92$$

anel 6

$$5.26F - 0.77G = -0.82$$
$$-0.65F + 3.81G = -0.79$$

$$F = -0.19 \quad G = -0.24$$

$$R_6 = -\frac{2.90x.19 - 2.95x.24}{3.90} - 0.27 = -0.59$$

$$M_{FG} = 3(-.19 - \frac{.24}{2} + .59) = .84$$

$$M_{GF} = 3(-.24 - .19 + .59) = .75$$

anel 7

$$4.03G - 1.C2H = -0.87$$
$$-0.93G + 2.52H = -0.86$$

$$G = -0.33 \quad H = -0.46$$

$$R_7 = -\frac{2.91x.33 - 2.96x.46}{3.91} - 0.22 = -0.82$$

$$M_{GH} = 4(-.33 - \frac{.44}{2} + .82) = 1.04$$

$$M_{HG} = 4(-.46 - \frac{.33}{2} + .82) = .80$$

anel 8

$$2.54H - 1.04I = -0.90$$
$$-0.90H + 2.52I = -0.88$$
$$H = -0.58 \quad I = -0.56$$

$$R_8 = -\frac{2.83 \text{ x } 0.58 - 2.91 \text{ x } 0.56}{3.83} - .22 = -1.08$$

$$M_{HI} = 4(-.58 - \frac{.56}{2} + 1.08) = .88$$

$$M_{IH} = 4(-.56 - \frac{.58}{2} + 1.08) = .92$$

Load at C

Panel 1

$$2.52A - .90B = 5.27$$
$$-1.04A + 2.54B = 5.38$$

$$A = 3.33 \qquad B = 3.48$$

$$R_1 = \frac{2.91 \times 3.33 + 2.63 \times 3.48}{3.82} + 1.35 = 6.47$$

$$M_{AB} = 4(3.33 + \frac{3.48}{2} - 6.47) = -5.88$$

$$M_{BA} = 4(3.48 + \frac{3.33}{2} - 6.47) = -5.32$$

Panel 2

$$2.52B - .93C = 5.17$$
$$-1.02 + 4.03C = 5.23$$
$$B = 2.79 \qquad C = 2.0$$

$$R_2 = \frac{2.96 \times 2.79 + 2.91 \times 2.0}{3.92} + 1.31 = 4.90$$

$$M_{BC} = 4(2.79 + \frac{2.0}{2} - 4.90) = -4.44$$

$$M_{CB} = 4(2.0 + \frac{2.79}{2} - 4.90) = -6.04$$

Panel 3

$$3.81C - .65D = -2.31$$
$$-.77C + 5.26D = -2.38$$

$$C = -.70 \qquad D = -.56$$

$$R_3 = -\frac{2.95 \times .70 - 2.90 \times .56}{3.90} - .79 = -1.74$$

$$M_{CD} = 3(-.70 - \frac{.56}{2} + 1.74) = 2.28$$

$$M_{DC} = 3(-.56 - \frac{.70}{2} + 1.74) = 2.49$$

Panel 4

$$5.0D - .5E = -1.87$$

$$-.5D + 6.5E = -1.87$$

$$D = -.41 \qquad E = -.32$$

$$R_4 = \frac{3}{4}(-.41 - .32) - .94 = -1.50$$

$$M_{DE} = 2(-.41 - \frac{.32}{2} + 1.50) = 1.86$$

$$M_{ED} = 2(-.32 - \frac{.41}{2} + 1.50) = 1.96$$

Panel 5

$E = -0.32$

$F = -0.40$

$R_5 = -1.48$

$M_{EF} = 1.92$

$M_{FE} = 1.84$

Panel 6

$F = -0.$[illegible]3

$G = $ [illegible]

$R_6 = -1.18$

$M_{FG} = 1.68$

$M_{GF} = 1.50$

Panel 7

$G = -0.$[illegible]6

$H = -0.$[illegible]

$R_7 = -1.$[illegible]4

$M_{GH} = 2.0$[illegible]

$M_{HG} = 1.60$

Panel 8

$H = -1.16$

$I = -1.1$[illegible]

$R_8 = -2.$[illegible]

$M_{HI} = 1.7$[illegible]

$M_{IH} = 1.84$

Load at D

$$2.52A - .90B = 4.38$$
$$-1.04A + 2.54B = 4.49$$

$$A = 2.79 \qquad B = 2.91$$

$$R_1 = \frac{2.91 \times 2.79 + 2.83 \times 2.91}{3.82} - 1.12 = 5.40$$

$$M_{AB} = 4(2.79 + \frac{2.91}{2} - 5.40) = -4.64$$

$$M_{BA} = 4(2.91 + \frac{2.79}{2} - 5.40) = -4.40$$

Panel 2

$$2.52B - .93C = 4.31$$
$$-1.02B + 4.03C = 4.36$$

$$B = 2.33 \qquad C = 1.66$$

$$R_2 = \frac{2.96 \times 2.33 + 2.91 \times 1.66}{3.92} - 1.09 = 4.09$$

$$M_{BC} = 4(2.33 + \frac{1.66}{2} - 4.09) = -3.72$$

$$M_{CB} = 4(1.66 + \frac{2.33}{2} - 4.09) = -5.08$$

Panel 3

$$3.81C - .65D = 3.98$$
$$-.77C + 5.26D = 4.12$$

$$C = 1.21 \qquad D = .96$$

$$R_3 = \frac{2.95 \times 1.21 + 2.90 \times .96}{3.90} - 1.37 = 2.99$$

$$M_{CD} = 3(1.21 + \frac{.96}{2} - 2.99) = -3.90$$

$$M_{DC} = 3(.96 + \frac{1.21}{2} - 2.99) = -4.29$$

Panel 4

$$5.0D - .5E = -2.82$$
$$-.5D + 6.5E = -2.82$$

$$D = -.61 \qquad E = -.48$$

$$R_4 = \frac{3}{4}(-.61 - .49) - 1.41 = -2.23$$

$$M_{DE} = 2(-.61 - \frac{.48}{2} + 2.23) = 2.76$$

$$M_{ED} = 2(-.48 - \frac{.61}{2} + 2.23) = 2.90$$

Panel 5

$E = -0.48$

$F = -1.60$

$R_5 = -2.22$

$M_{EF} = 2.88$

$M_{FE} = 2.76$

Panel 6

$F = -0.57$

$G = -1.72$

$R_6 = -1.77$

$M_{FG} = 2.52$

$M_{GF} = 2.25$

Panel 7

$G = -0.99$

$H = -1.39$

$R_7 = -2.46$

$M_{GH} = 3.12$

$M_{HG} = 2.40$

Panel 8

$H = -1.74$

$I = -1.68$

$R_8 = -3.24$

$M_{HI} = 2.64$

$M_{IH} = 2.76$

Load at E

Panel 1

$$2.52A - .9B = 3.51$$

$$-1.04A + 2.54B = 3.59$$

$$A = 2.22 \quad B = 2.33$$

$$R_1 = \frac{2.91 \times 2.22 + 2.83 \times 2.33}{3.82} + .90 = 4.32$$

$$M_{AB} = 4(2.22 + \frac{2.33}{2} - 4.32) = -3.76$$

$$M_{BA} = 4(2.33 + \frac{2.22}{2} - 4.32) = -3.52$$

Panel 2

$$2.52B - .93C = 3.44$$

$$-1.02B + 4.03C = 3.49$$

$$B = 1.86 \quad C = 1.33$$

$$R_2 = \frac{2.96 \times 1.86 + 2.91 \times 1.33}{3.92} + .87 = 3.26$$

$$M_{BC} = 4(1.86 + \frac{1.33}{2} - 3.26) = -2.96$$

$$M_{CB} = 4(2.33 + \frac{1.86}{2} - 3.26) = -4.00$$

Panel 3

$$3.81C - .65D = 3.18$$

$$-.77C + 5.26D = 3.30$$

$$C = .97 \quad D = .77$$

$$R_3 = \frac{2.95 \times .97 + 2.90 \times .77}{3.90} + 1.10 = 2.40$$

$$M_{CD} = 3(.97 + .77/2 - 2.40) = -3.15$$

$$M_{DC} = 3(.77 + .97/2 - 2.40) = -3.84$$

Panel 4

$$5.0D - .5E = 3.75$$

$$-.5D + 6.5E = 3.75$$

$$D = .82 \quad E = .64$$

$$R_4 = 3/4(.82 + .64) + 1.88 = 2.97$$

$$M_{DE} = 2(.82 + .64/2 - 2.97) = -3.66$$

$$M_{ED} = 2(.64 + .82/2 - 2.97) = -3.84$$

Panel 5

$E = -0.64$

$F = -0.80$

$R_5 = -2.96$

$M_{EF} = 3.84$

$M_{FE} = 3.68$

Panel 6

$F = -0.76$

$G = -0.96$

$R_6 = -2.36$

$M_{FG} = 3.36$

$M_{GF} = 3.00$

Panel 7

$G = -1.32$

$H = -1.84$

$R_7 = -3.28$

$M_{GH} = 4.16$

$M_{HG} = 3.20$

Panel 8

$H = -2.32$

$I = -2.24$

$R_8 = -4.32$

$M_{HI} = 3.52$

$M_{IH} = 3.68$

First Moment Corrections - Load at B

Panel 1

$$2.52A - .90B = 0$$

$$-1.04A + 2.54B = -1.00$$

$$A = -.16 \quad B = -.46$$

$$R_1 = \frac{-2.91x.16 - 2.83x.46}{3.83} = -0.46$$

$$M_{AB} = 4(-.16 - .46/2 + .46) = .28$$

$$M_{BA} = 4(-.46 - .16/2 + .46) = -.32$$

Panel 2

$$2.52B - .93C = 5.80$$

$$-1.02B + 4.03C = -1.14$$

$$B = 2.42 \quad C = .33$$

$$R_2 = \frac{2.96x2.42 + 2.91x.33}{3.91} = 2.07$$

$$M_{BC} = 4(2.42 + .33/2 - 2.07) = 2.04$$

$$M_{CB} = 4(.33 + 2.42/2 - 2.07) = -2.16$$

Panel 3

$$3.81C - .65D = -1.40$$

$$-.77C + 5.26D = - .92$$

$$C = -.40 \quad D = -.23$$

$$R_3 = \frac{-2.95x.40 - 2.90x.23}{3.90} = -.47$$

$$M_{CD} = 3(-.40 - .23/2 + .47) = -.12$$

$$M_{DC} = 3(-.23 - .40/2 + .47) = .12$$

Panel 4

$$6.5D - 0.5E = -1.26$$

$$-0.5D + 5.0E = - .96$$

$$D = -.22 \quad E = -.21$$

$$R_4 = 3/4(-.22 - .21) = -.32$$

$$M_{DE} = 2(-.22 - .21/2 + .32) = 0$$

$$M_{ED} = 2(-.21 - .22/2 + .32) = 0$$

Panel 5

$$5.0E - 0.5F = -.96$$

$$-0.5 + 6.5F = -.84$$

$$E = -.21, \quad F = -.14$$

$$R_5 = \frac{3}{4}(-.21 - .14) = -.26$$

$$M_{EF} = 2(-.21 - \frac{.14}{2} + .26) = -.04$$

$$M_{FE} = 2(-.14 - \frac{.21}{2} + .26) = .04$$

Panel 6

$$5.26F - 0.77G = -.92$$

$$-0.65F + 3.81G = -1.04$$

$$F = -.22, \quad G = -.31$$

$$R_6 = \frac{-2.90 \times .22 - 2.95 \times .31}{3.90} = .40$$

$$M_{FG} = 3(-.22 - \frac{.31}{2} + .40) = .06$$

$$M_{GF} = 3(-.31 - \frac{.22}{2} + .40) = -.06$$

Panel 7

$$4.03G - 1.02H = -.75$$

$$-0.93G + 2.52H = -.88$$

$$G = -.30, \quad H = -.46$$

$$R_7 = \frac{-2.91 \times .30 - 2.96 \times .46}{3.91} = -.57$$

$$M_{GH} = 4(-.30 - \frac{.46}{2} + .57) = .16$$

$$M_{HG} = 4(-.46 - \frac{.30}{2} + .57) = -.16$$

Panel 8

$$2.54H - 1.04I = -.60$$
$$-0.94H + 2.52I = 0$$

$$H = -.37, \quad I = -.13$$

$$R_8 = \frac{-2.83 \times .37 - 2.91 \times .13}{3.83} = -.37$$

$$M_{HI} = 4(-.37 - \frac{.13}{2} + .37) = -.24$$

$$M_{IH} = 4(-.13 - \frac{.37}{2} + .37) = .24$$

Second Moment Corrections-Load at B

Panel 1

$$2.52A - .90B = 0$$

$$-1.04A + 2.54B = -2.04$$

$$A = -.34 \ , \ B = -.94$$

$$R_1 = \frac{-2.91 \times .34 - 2.83 \times .94}{3.83} = -.95$$

$$M_{AB} = 4(-.34 - \frac{.94}{2} + .95) = .56$$

$$M_{BA} = 4(-.94 - \frac{.34}{2} + .95) = -.64$$

Panel 3

$$3.81C - .65D = -2.18$$

$$-.77C + 5.26D = 0$$

$$C = -.58 \ , \ D = -.08$$

$$R_3 = \frac{-2.95 \times .58 - 2.90 \times .08}{3.90} = -.50$$

$$M_{CD} = 3(-.58 - \frac{.08}{2} + .50) = -.36$$

$$M_{DC} = 3(-.08 - \frac{.58}{2} + .50) = .39$$

Load at B

anel	1		2		3		4	
oint	A	B	B	C	C	D	D	E
Q	6.14	6.28	-1.20	-1.21	-1.16	-1.19	-.94	-.94
α	3.89	4.07	-.65	-.46	-.35	-.28	-.20	-.16
R	7.45		-1.13		-.87		-.74	
M'	-6.12	-5.80	1.00	1.40	1.14	1.26	.92	.96
Q	0	-1.00	5.80	-1.14	-1.40	-.92	-1.26	-.98
α	-.16	-.46	2.42	.32	-.40	-.23	-.22	-.21
R	-.46		2.07		-.47		-.32	
M''	.28	-.32	2.04	-2.16	-.12	.12	0	0
Q	0	-2.04	.32	.12	-2.16	0	-.12	.04
α	-.34	-.94			-.58	-.08		
R	-.95				-.50			
M'''	.56	-.64	0	0	-.36	.39	.0[illegible]	.0[illegible]
M	-5.28	-6.76	3.04	-0.76	.66	1.77	.92	.96

anel	5		6		7		8	
oint	E	F	F	G	G	H	H	I
Q	-.94	-.94	-.82	-.79	-.87	-.86	-.90	-.88
[illegible]	-.16	-.20	-.19	-.24	-.33	-.46	-.58	-.56
R	-.74		-.59		-.82		-1.08	
M'	.96	.92	.34	.75	1.04	.80	.88	.92
Q	-.96	-.84	-.92	-1.04	-.75	-.88	-.80	0
[illegible]	-.21	-.14	-.22	-.31	-.30	-.46	-.37	-.13
R	-.26		-.40		-.57		-.37	
M"	-.04	-.04	.06	-.06	.16	-.16	-.24	.24
Q	0	-.06	-.04	.16	.06	.24	.16	0
[illegible]								
R								
M'''	0	0	0	0	0	0	0	0
M	.92	.96	.90	.69	1.20	.64	.64	1.1[illegible]

First Moment Corrections - Load at C

Panel 1

$$2.52A - .93B = 0$$

$$-1.04A + 2.54B = 4.44$$

$$A = .73 \quad B = 2.05$$

$$R_1 = \frac{2.91x.73 + 2.83x2.05}{3.83} = 2.06$$

$$M_{AB} = 4(.73 + 2.05/2 - 2.06) = -1.24$$

$$M_{BA} = 4(2.05 + .73/2 - 2.06) = 1.40$$

Panel 2

$$2.52B - .93C = 5.32$$

$$-1.02B + 4.03C = -2.28$$

$$B = 2.10 \quad C = -.04$$

$$R_2 = \frac{2.93x2.10 - 2.91x.04}{3.91} = 1.60$$

$$M_{BC} = 4(2.10 - .04/2 - 1.60 = 1.92$$

$$M_{CB} = 4(-.04 + 2.10/2 - 1.60) = -2.04$$

Panel 3

$$3.81C - 0.65D = 6.04$$

$$-0.77C + 5.26D = -1.86$$

$$C = 1.56 \quad D = -.12$$

$$R_3 = \frac{2.95x1.56 - 2.90x.12}{3.90} = 1.09$$

$$M_{CD} = 3(1.56 - .12/2 - 1.09) = 1.23$$

$$M_{DC} = 3(-.12 + 1.56/2 - 1.09) = -1.29$$

Panel 4

$$6.5D - 0.5E = -2.49$$

$$-0.5D + 5.0E = -1.92$$

$$D = -.42 \quad E = -.42$$

$$R_4 = 3/4(-.42 - .42) = -.63$$

$$M_{DE} = 2(-.42 - .42/2 + .63) = 0$$

$$M_{ED} = 2(-.42 - .42/2 + .63) = 0$$

Panel 5

$$5.0E - 0.5F = -1.96$$

$$-0.5E + 6.5F = -1.68$$

$$E = -.42 \quad F = -.29$$

$$R_5 = 3/4(-.42 - .29) = -.53$$

$$M_{EF} = 2(-.42 - .29/2 + .53) = -.06$$

$$M_{FE} = 2(-.29 - .42/2 + .53) = .06$$

Panel 6

$$5.26F - 0.77G = -1.84$$

$$-0.65F + 3.81G = -2.08$$

$$F = -.44 \quad G = -.62$$

$$R_6 = \frac{-2.90x.44 - 2.95x.62}{3.90} = -.80$$

$$M_{FG} = 3(-.44 - .62/2 + .80) = .15$$

$$M_{GF} = 3(-.29 - .44/2 + .80) = -.12$$

Panel 7

$$4.03G - 1.02H = -1.50$$

$$-0.93G + 2.52H = -1.76$$

$$G = -.60 \quad H = -.92$$

$$R_7 = \frac{-2.91x.60 - 2.96x.92}{3.91} = -1.14$$

$$M_{GH} = 4(-.60 - .92/2 + 1.14) = .32$$

$$M_{HG} = 4(-.92 - .60/2 + 1.14) = -.32$$

Panel 8

$$2.54H - 1.04I = -1.60$$

$$-0.90H + 2.52I = 0$$

$$H = -.74 \quad I = -.26$$

$$R_8 = \frac{-2.83x.74 - 2.91x.26}{3.83} = -.74$$

$$M_{HI} = 4(-.74 - .26/2 + .74) = -.52$$

$$M_{IH} = 4(-.26 - .74/2 + .74) = .44$$

Second Moment Corrections - Load at C

Panel 1

$$2.52A - 0.90B = 0$$

$$-1.04A + 2.54B = -1.92$$

$$A = -.32 \qquad B = -.88$$

$$R_1 = \frac{-2.91x.32 - 2.83x.88}{3.83} = -.89$$

$$M_{AB} = 4(-.32 - .88/2 + .89) = .52$$

$$M_{BA} = 4(-.88 - .32/2 + .89) = -.60$$

Panel 2

$$2.52B - 0.93C = -1.40$$

$$-1.02B + 4.03C = -1.23$$

$$B = -.74 \qquad C = -.49$$

$$R_2 = \frac{-2.96x.74 - 2.91x.49}{3.91} = -.93$$

$$M_{BC} = 4(-.74 - .49/2 + .93) = -.24$$

$$M_{CB} = 4(-.49 - .74/2 + .93) = .28$$

Panel 3

$$3.81C - 0.65D = 2.04$$

$$-0.77C + 5.28D = 0$$

$$C = .55 \qquad D = .08$$

$$R_3 = \frac{2.95x.55 + 2.90x.08}{3.90} = .47$$

$$M_{CD} = 3(.55 + .08/2 - .47) = .36$$

$$M_{DC} = 3(.08 + .55/2 - .47) = -.36$$

Panel 4

$$6.5D - 0.5E = 1.29$$

$$-0.5D + 5.0E = .06$$

$$D = .20 \qquad E = .03$$

$$R_4 = 3/4(.20 + .03) = .17$$

$$M_{DE} = 2(.20 + .03/2 - .17) = .08$$

$$M_{ED} = 2(.03 + .20/2 - .17) = -.08$$

nel 5
$$5.0E - 0.5F = 0$$
$$-0.5E + 6.5F = -.15$$
$$E = 0 \qquad F = -.02$$
$$R_5 = 3/4(-.02) = -.02$$
$$M_{EF} = 0$$
$$M_{FE} = 0$$

nel 6
$$5.26F - 0.77G = -.06$$
$$-0.65F + 3.81G = -.32$$
$$F = -.02 \qquad G = -.08$$
$$R_6 = \frac{-2.90x.02 - 2.95x.08}{3.90} = -.07$$
$$M_{FG} = 3(-.02 - .08/2 + .07) = .03$$
$$M_{GF} = 3(-.08 - .02/2 + .07) = -.06$$

nel 7
$$4.03G - 1.02H = .12$$
$$-0.93G + 2.52H = .52$$
$$G = .09 \qquad H = .24$$
$$R_7 = \frac{2.91x.09 + 2.96x.24}{3.91} = .25$$
$$M_{GH} = 4(.09 + .24/2 - .25) = -.16$$
$$M_{HG} = 4(.24 + .09/2 - .25) = .16$$

nel 8
$$2.54H - 1.04I = .32$$
$$-0.90H - 2.52I = 0$$
$$H = .15 \qquad I = .05$$
$$R_8 = \frac{2.83x.15 + 2.91x.05}{3.83} = .15$$
$$M_{HI} = 4(.15 + .05/2 - .15) = .10$$
$$M_{IH} = 4(.05 + .15/2 - .15) = -.10$$

Load at C

Panel	1		2		3		4	
Joint	A	B	B	C	C	D	D	E
Q	5.27	5.38	5.17	5.23	-2.31	-2.38	-1.87	-1.87
α	3.33	3.48	2.79	2.00	- .70	- .56	- .41	- .32
R	6.47		4.90		-1.74		-1.50	
M'	-5.88	-5.32	-4.44	-6.04	2.28	2.49	1.86	1.96
Q	0	4.44	5.32	-2.28	6.04	-1.86	-2.49	-1.92
α	.73	2.05	2.10	- .04	1.56	- .12	- .42	- .42
R	2.06		1.60		1.09		- .63	
M''	-1.24	1.40	1.92	-2.04	1.23	-1.29	0	0
Q	0	-1.92	-1.40	-1.23	2.04	0	1.29	.06
	- .32	- .88	- .74	- .49	.55	.08	.20	.03
R	- .89		- .93		.47		.17	
M'''	.52	- .60	- .24	.28	.36	- .36	.08	- .08
M	-6.60	-4.52	-3.76	-7.80	3.87	.84	1.94	1.88

5		6		7		8	
E	F	F	G	G	H	H	I
1.88	-1.88	-1.64	-1.58	-1.74	-1.72	-1.80	-1.76
.32	- .40	- .38	- .48	- .66	- .93	-1.16	-1.12
1.48		-1.16		-1.64		-2.16	
1.92	1.84	1.68	1.50	2.08	1.60	1.76	1.84
1.96	-1.68	-1.84	-2.08	-1.50	-1.76	-1.60	0
.42	- .29	- .44	- .62	- .60	- .92	- .74	- .26
.53		- .80		-1.14		- .74	
.06	.06	.15	- .12	.32	- .32	- .52	.44
0	- .15	- .06	- .32	.12	.52	.32	0
0	- .02	- .02	- .08	.09	.24	.15	.05
.02		- .07		.25		.15	
0	0	.03	- .06	- .16	.16	.10	- .10
1.86	1.90	1.86	1.32	2.24	1.44	1.34	2.28

Panel 5 $$-.5F + 6.5E = -2.90$$

$$5.0F - .5E = -2.52$$

$$E = -.49\ ,\ F = -.55\ ,\ R_5 = -.76$$

$$M_{EF} = 2(-.49 - .55/2 + .76) = .04$$

$$M_{FE} = 2(-.55 - .49/2 + .76) = -.02$$

Panel 6 $$-.77G + 5.26F = -2.76$$

$$3.81G - .65F = -3.12$$

$$F = -.66\ ,\ G = -.93\ ,\ R_6 = -1.20$$

$$M_{FG} = 3(-.66 - .93/2 + 1.20) = .21$$

$$M_{GF} = 3(-.93 - .66/2 + 1.20) = -.18$$

Panel 7 $$-1.02H + 4.03G = -2.25$$

$$2.52H - .93G = -2.64$$

$$G = -.91\ ,\ H = -1.38\ ,\ R_7 = -1.71$$

$$M_{GH} = 4(-.91 - 1.38/2 + 1.71) = .44$$

$$M_{HG} = 4(-1.38 - .91/2 + 1.71) = -.48$$

Panel 8 $$-1.04I + 2.54H = -2.40$$

$$2.52I - .90H = 0$$

$$H = -1.11\ ,\ I = -.39\ ,\ R_8 = -1.12$$

$$M_{HI} = 4(-1.11 - .39/2 + 1.12) = -.72$$

$$M_{IH} = 4(-.39 - 1.11/2 + 1.12) = .72$$

Influence Line Corrections - Second Set - Load at D

Panel 1
$$2.52A - .90B = 0$$
$$-1.04A + 2.54B = -.80$$
$$A = -.13\ ,\ B = -.37\ ,\ R_1 = -.37$$
$$M_{AB} = 4(-.13 - .37/2 + .37) = .24$$
$$M_{BA} = 4(-.37 - .13/2 + .37) = -.24$$

Panel 2
$$2.52B - .93C = -1.08$$
$$-1.02B + 4.03C = -1.17$$
$$B = -.59\ ,\ C = -.44\ ,\ R_2 = -.77$$
$$M_{BC} = 4(-.59 - .44/2 + .77) = -.16$$
$$M_{CB} = 4(-.44 - .59/2 + .77) = .16$$

Panel 3
$$3.81C - .65D = .76$$
$$-.77C + 5.26D = -.60$$
$$C = .18\ ,\ D = -.09\ ,\ R_3 = .08$$
$$M_{CD} = 3(.18 - .09/2 - .08) = .18$$
$$M_{DC} = 3(-.09 + .18/2 - .08) = -.24$$

Panel 4
$$5.0D - .5E = 1.26$$
$$-.5D + 6.5E = -.04$$
$$D = .25\ ,\ E = .01\ ,\ R_4 = .20$$
$$M_{DE} = 2(.25 + .01/2 - .20) = .10$$
$$M_{ED} = 2(.01 + .25/2 - .20) = -.14$$

Panel 5 $$-.5F + 6.5E = .60$$

$$5.0F - .5E = -.21$$

$$E = .09 , F = -.03 , R_5 = .04$$

$$M_{EF} = 2(.09 - .03/2 - .04) = .08$$

$$M_{FE} = 2(-.03 + .09/2 - .04) = -.06$$

Panel 6 $$-.77G + 5.26F = .02$$

$$3.81G - .65F = -.44$$

$$F = -.01 , G = -.12 , R_6 = -.10$$

$$M_{FG} = 3(-.01 - .12/2 + .10) = .09$$

$$M_{GF} = 3(-.12 - .01/2 + .10) = -.09$$

Panel 7 $$-1.02H + 4.03G = .18$$

$$2.52H - .93G = .72$$

$$G = .13 , H = .33 , R_7 = .35$$

$$M_{GH} = 4(.13 + .33/2 - .35) = -.24$$

$$M_{HG} = 4(.33 + .13/2 - .35) = .20$$

Panel 8 $$-1.04I + 2.54H = .48$$

$$2.52I - .90H = 0$$

$$H = .22 , I = .08 , R_8 = .22$$

$$M_{HI} = 4(.22 + .08/2 - .22) = .16$$

$$M_{IH} = 4(.08 + .22/2 - .22) = -.12$$

Load at D

Panel	1		2		3		4	
Point	A	B	B	C	C	D	D	E
Q	4.38	4.49	4.31	4.36	3.98	4.12	-2.82	-2.82
α	2.79	2.91	2.33	1.66	1.21	.96	- .61	- .48
R	5.40		4.09		2.99		-2.23	
M'	-4.64	-4.40	-3.72	-5.08	-3.90	-4.29	2.76	2.90
Q	0	3.72	4.40	3.90	5.08	-2.76	4.29	-2.88
	.61	1.72	2.32	1.55	1.28	- .34	.82	- .38
R	1.74		2.90		.72		.33	
M''	-1.08	1.08	.80	- .76	1.17	-1.26	.60	- .60
Q	0	- .80	-1.08	-1.17	.76	- .60	1.26	- .04
	- .13	- .37	- .59	- .44	.18	- .09	.25	.01
R	- .37		- .77		.08		.20	
M'''	.24	- .24	- .16	.16	.18	- .24	.10	- .14
M	-5.48	-3.36	-3.08	-5.68	-2.53	-5.79	3.46	2.16

Load at D

nel	1		2		3		4	
int	A	B	B	C	C	D	D	E
Q	4.38	4.49	4.31	4.36	3.98	4.12	-2.82	-2.82
α	2.79	2.91	2.33	1.66	1.21	.96	- .61	- .48
R	5.40		4.09		2.99		-2.23	
M'	-4.64	-4.40	-3.72	-5.08	-3.90	-4.29	2.76	2.90
Q	0	3.72	4.40	3.90	5.08	-2.76	4.29	-2.88
	.61	1.72	2.32	1.55	1.28	- .34	.82	- .38
R	1.74		2.90		.72		.33	
M''	-1.08	1.08	.80	- .76	1.17	-1.26	.60	- .60
Q	0	- .80	-1.08	-1.17	.76	- .60	1.26	- .04
	- .13	- .37	- .59	- .44	.18	- .09	.25	.01
R	- .37		- .77		.08		.20	
M'''	.24	- .24	- .16	.16	.18	- .24	.10	- .14
M	-5.48	-3.36	-3.08	-5.68	-2.53	-5.79	3.46	2.16

	5		6		7		8
E	F	F	G	G	H	H	I
2.82	-2.82	-2.46	-2.37	-2.61	-2.58	-2.70	-2.64
.48	- .60	- .57	- .72	- .99	-1.39	-1.74	-1.68
2.22		-1.77		-2.46		-3.24	
2.88	2.76	2.52	2.25	3.12	2.40	2.64	2.76
2.90	-2.52	-2.76	-3.12	-2.25	-2.64	-2.40	0
.49	- .55	- .66	- .93	- .91	-1.38	-1.11	- .39
.78		-1.20		-1.71		-1.12	
.04	- .02	.21	- .18	.44	- .48	- .72	.72
.60	- .21	.02	- .44	.18	.72	.48	0
.09	- .03	- .01	- .12	.13	.33	.22	.08
.04		- .10		.35		.22	
.08	- .06	.09	- .09	- .24	.20	.16	- .12
3.00	2.68	2.82	1.98	3.32	2.12	2.08	3.36

Influence Line Corrections - First Set - Load at E

anel 1,8

$$2.52A - .90B = 0$$

$$-1.04A + 2.54B = 2.96$$

$$A = .49\ ,\ B = 1.37\ ,\ R_1 = 1.39$$

$$M_{AB} = 4(.49 + 1.37/2 - 1.39) = -.88$$

$$M_{BA} = 4(1.37 + .49/2 - 1.39) = .88$$

anel 2,7

$$2.52B - .93C = 3.52$$

$$-1.02B + 4.03C = 3.15$$

$$B = 1.86\ ,\ C = 1.25\ ,\ R_2 = 2.33$$

$$M_{BC} = 4(1.86 + 1.25/2 - 2.33) = .60$$

$$M_{CB} = 4(1.25 + 1.86.2 - 2.33) = -.60$$

anel 3,6

$$3.81C - .65D = 4.00$$

$$-.77C + 5.26D = 3.66$$

$$C = 1.20\ ,\ D = .87\ ,\ R_3 = 1.55$$

$$M_{CD} = 3(1.20 + .87/2 - 1.55) = .24$$

$$M_{DC} = 3(.87 + 1.20/2 - 1.55) = -.24$$

andl 4,5

$$5.0D - .5E = 3.45$$

$$-.5D + 6.5E = -.84$$

$$D = .64\ ,\ E = -.54\ ,\ R_4 = .08$$

$$M_{DE} = 2(.64 - .54/2 - .08) = .58$$

$$M_{ED} = 2(-.54 + .64/2 - .08) = -.60$$

Influence Line Corrections - Second Set - Load at E

Panel 1,8

$$2.52A - .90B = 0$$

$$-1.04A + 2.54B = -.60$$

$$A = -.10 \ , \ B = -.28 \ , \ R_1 = -.28$$

$$M_{AB} = 4(-.10 - .28/2 + .28) = .16$$

$$M_{BA} = 4(-.28 - .10/2 + .28) = -.20$$

Panel 2,7

$$2.52B - .93C = -.88$$

$$-1.02B + 4.\ 3C = -.24$$

$$B = -.41 \ , \ C = -.16 \ , \ R_2 = -.43$$

$$M_{BC} = 4(-.41 - .16/2 + .43) = -.24$$

$$M_{CB} = 4(-.16 - .41/2 + .43) = .24$$

Panel 3,6

$$3.81C - .65D = .60$$

$$-.77C + 5.26D = -.58$$

$$C = .14 \ , \ D = -.09 \ , \ R_3 = .04$$

$$M_{CD} = 3(.14 - .09/2 - .04) = .18$$

$$M_{DC} = 3(-.09 + .14/2 - .04) = -.18$$

Panel 4,5

$$5.\ D - .5E = .24$$

$$-.5D + 6.5E = -.60$$

$$D = .04 \ , \ E = -.09 \ , \ R_4 = -.04$$

$$M_{DE} = 2(.04 - .09/2 + .04) = .06$$

$$M_{ED} = 2(-.09 + .04/2 + .04) = -.\ 6$$

Load at E

anel	1		2		3		4	
oint	A	B	B	C	C	D	D	E
Q	3.51	3.59	3.44	3.49	3.18	3.30	3.75	3.75
α	2.22	2.33	1.86	1.33	.97	.77	.82	.64
R	4.32		3.26		2.40		2.97	
M'	-3.76	-3.52	-2.96	-4.00	-3.15	-3.45	-3.66	-3.84
Q	0	2.96	3.52	3.15	4.00	3.66	3.45	-3.84
α	.49	1.37	1.86	1.25	1.20	.87	.64	- .54
R	1.39		2.33		1.55		.08	
M''	- .88	.88	.60	- .60	.24	- .24	.58	- .60
Q	0	- .60	- .88	- .24	.60	- .58	.24	- .60
α	- .10	- .28	- .41	- .16	.14	- .09	.04	- .09
R	- .28		- .[illegible]3		.04		- .04	
M'''	.16	- .20	- .24	.24	.18	- .18	.06	- .06
M	-4.48	-2.84	-2.60	-4.36	-2.73	-3.87	-3.02	-4.50

	5		6		7		8
E	F	F	G	G	H	H	I
3.75	-3.75	-3.30	-3.18	-3.49	-3.44	-3.59	-3.51
.64	- .82	- .77	- .97	-1.33	-1.86	-2.73	-2.22
2.97		-2.40		-3.26		-4.32	
3.84	3.66	3.45	3.15	4.00	2.96	3.52	3.76
3.84	-3.45	-3.66	-4.00	-3.15	-3.52	-2.96	0
.54	- .64	- .87	-1.20	-1.25	-1.86	-1.37	- .49
.08		-1.5[illegible]		-2.33		-1.39	
.60	- .58	.24	- .24	.60	- .60	- .88	.88
.60	- .24	.58	- .60	.24	.88	.60	0
.09	- .04	.09	- .14	.16	.41	.28	.10
.04		- .04		.43		.28	
.06	- .06	.18	- .18	- .24	.24	.20	- .16
4.50	3.02	3.87	2.73	4.36	2.60	2.84	4.48

Moment Computations - Web Members

mber AA' DL = 3510 fk

LL-H60 = 3008

Impact = 644

Total = 7162

LL H15-S12-44 = 412

Conc. = 97

Impact = 70

Total = 579

Sidewalk = 246

Design Moment = 7,987 fk

mber BB' DL = 3980 fk

LL-H60 = 3395

Impact = 725

Total = 8100

LL H15-S12-44 = 465

Conc. = 109

Impact = 78

Total = 652

Sidewalk = 278

Design Moment = 9,030 fk

mber CC' DL = 3690 fk

LL-H60 = 3200

Impact = 736

Total = 7626

LL H15-S12-44 = 432

Conc. = 101

Impact = 80

Total = 613

Sidewalk = 258

Design Moment = 8,497 fk

ber DD'

DL = 2422 f.k.

LL-E60 = 2193

Impact = 590

Total 5205

LL H15-S12 - 44 = 284
Conc. = 97
Impact = 66

Total = 447

Sidewalk = 192

Design Moment = 5,844 f. k.

ber EE'

DL = 1323 f.k.
LL-E60 = 1272
Impact = 445

Total = 3040

LL H15-S12-44 = 155
Conc. = 73
Impact = 47

Total = 275

Sidewalk = 120

Design Moment = 3,435 f.k.

Moment Computations - Chord Members

ber AB

DL	=	3510 f.k.
LL-E60	=	3008
Impact	=	644
Total	=	7162

LL H15-S12-44	=	412
Conc.	=	97
Impact	=	70
Total	=	579
Sidewalk	=	246

Design Moment = 7,987 f.k.

mber BC

DL	=	3120 f.k.
LL-E60	=	2800
Impact	=	642
Total	=	6562

LL H15-S12-44	=	365
Conc.	=	105
Impact	=	71
Total	=	541
Sidewalk	=	226

Design Moment = 7,329 f.k.

er CD

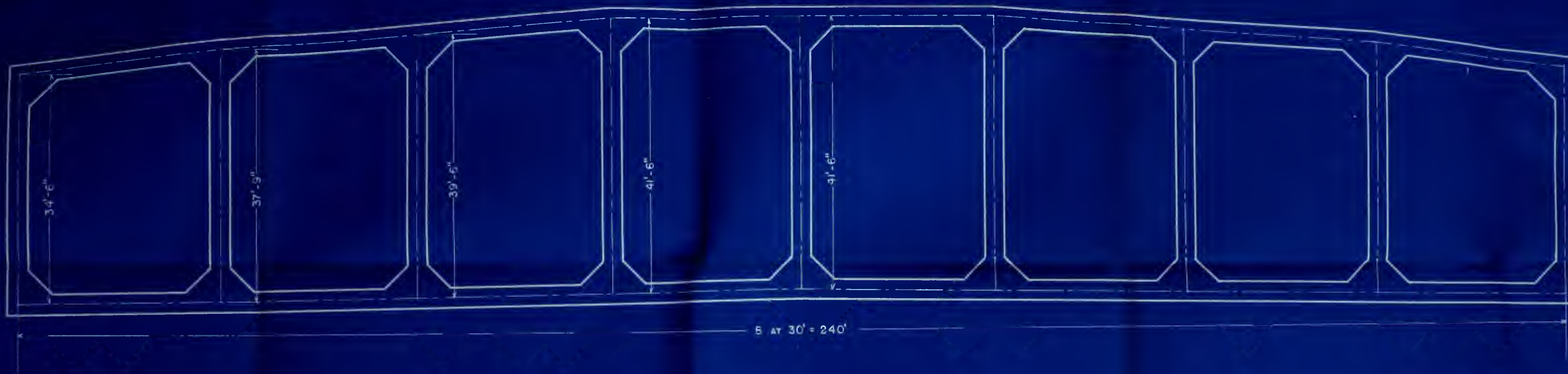
DL	=	1828
LL-E60	=	1692
Impact	=	434
Total		3954
LL H15-S12-44	=	214
Conc.	=	78
Impact	=	49
Total	=	341
Sidewalk	=	141

Design Moment = 4,436 f.k.

ber DE

DL	=	1172
LL-E60	=	1138
Impact	=	342
Total	=	2652
LL H15-S12-44	=	137
Conc.	=	61
Impact	=	37
Total	=	235
Sidewalk	=	99

Design Moment = 2,986 f.k.



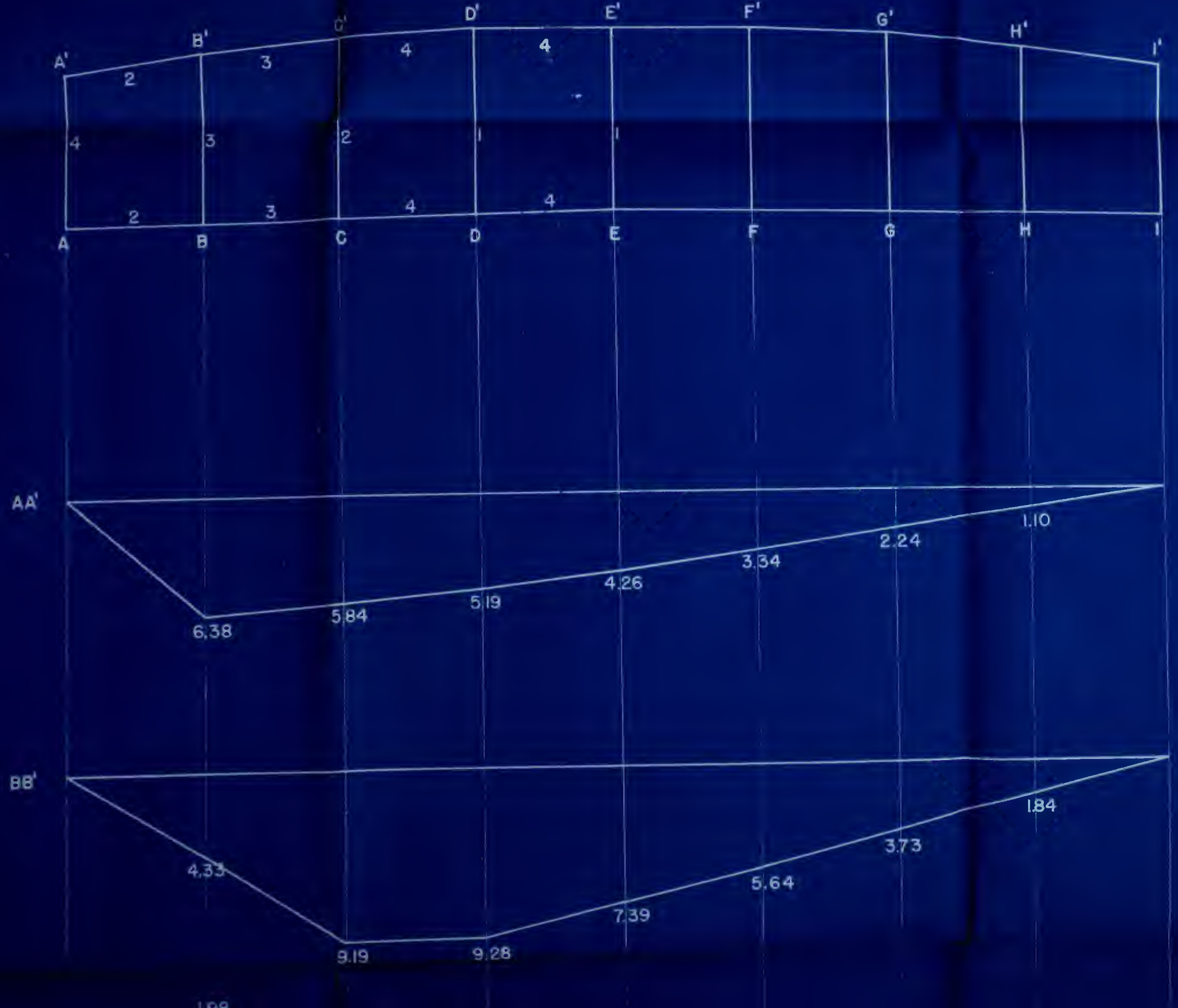
$m = \frac{37.75 - 34.50}{37.75} = 0.0866$ $m = \frac{39.50 - 37.75}{39.50} = 0.0443$ $m = \frac{41.50 - 39.50}{41.50} = 0.0482$ $m = \frac{41.50 - 41.50}{41.50} = 0$ $m = \frac{41.50 - 41.50}{41.50} = 0$ $m = \frac{41.50 - 39.50}{41.50} = 0.0482$ $m = \frac{39.50 - 37.75}{39.50} = 0.0443$ $m = \frac{37.75 - 34.50}{37.75} = 0.0866$

$n = \frac{37.75 - 34.50}{34.50} = 0.0942$ $n = \frac{39.50 - 37.75}{37.75} = 0.0463$ $n = \frac{41.50 - 39.50}{39.50} = 0.0507$ $n = \frac{41.50 - 41.50}{41.50} = 0$ $n = \frac{41.50 - 41.50}{41.50} = 0$ $n = \frac{41.50 - 39.50}{39.50} = 0.0507$ $n = \frac{39.50 - 37.75}{37.75} = 0.0463$ $n = \frac{37.75 - 34.50}{34.50} = 0.0942$

ELEVATION
VIERENDEEL TRUSS
RENSSELAER POLYTECHNIC INSTITUTE

JUNE 1948 SCALE 1" = 10'

J. J. MANNING JR. L. H. EDING


A'
B'
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1
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G
H
I
AA'
1.10
2.24
3.34
4.26
5.19
5.84
6.38
BB'
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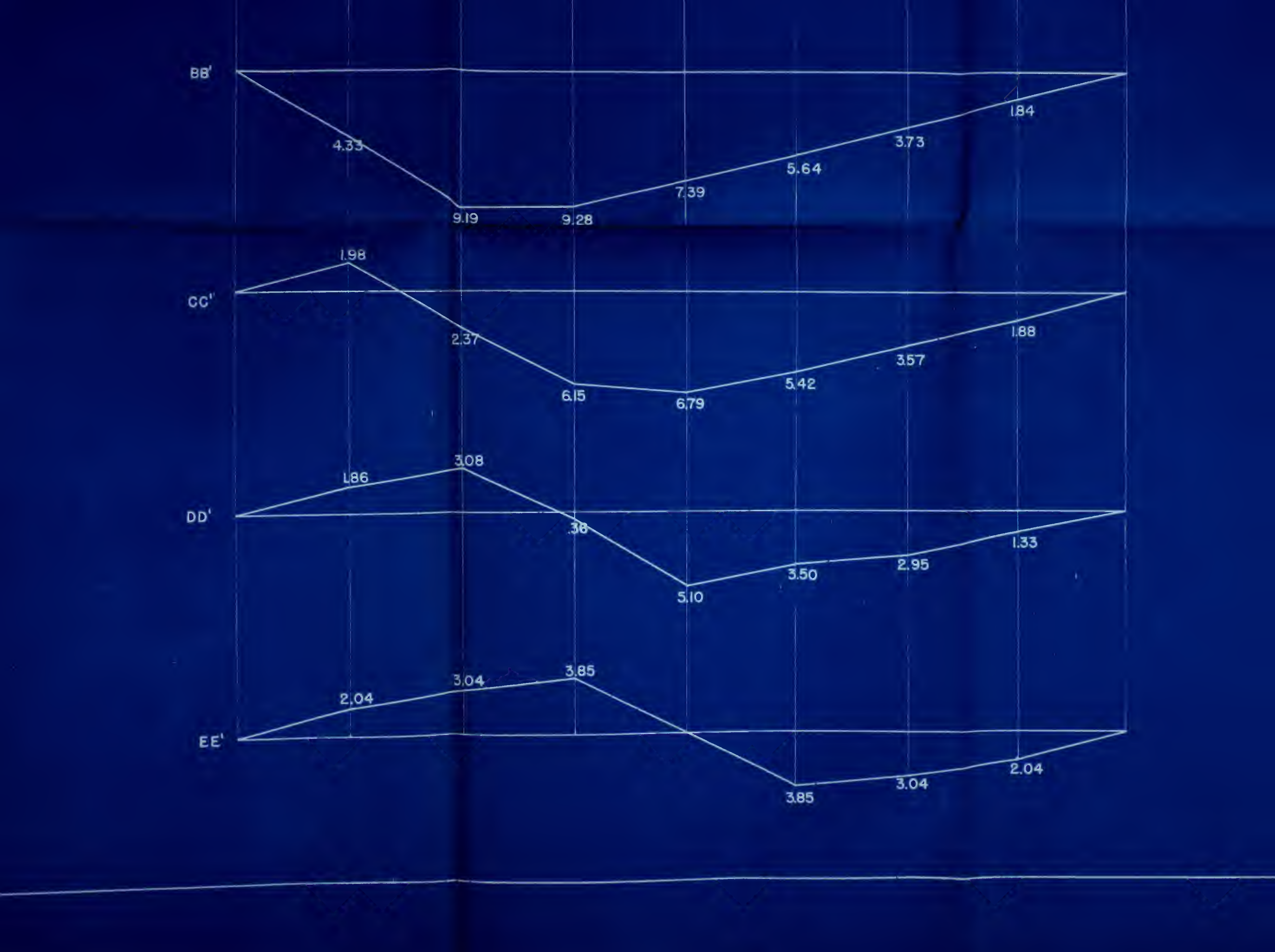
9.19
4.33



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9.19
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CC'
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DD'
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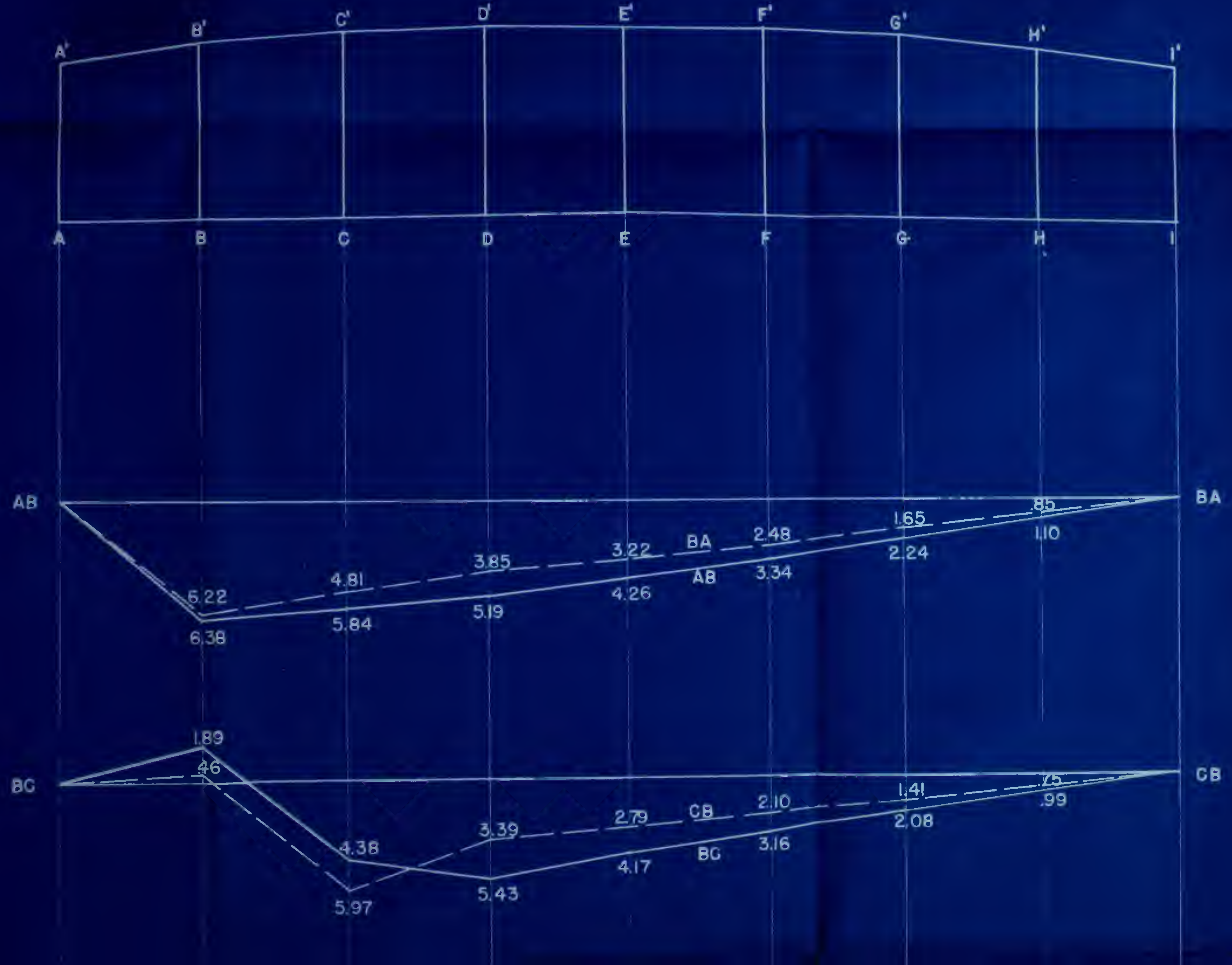

A'
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.85
1.65
1.10
2.48
2.24
3.22
BA
3.85
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AB
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5.84
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1.89
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BC
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2.08
2.79
CB
3.39
3.16
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BC
4.17
5.43
5.97

INFLUENCE LINES

FIRST SET

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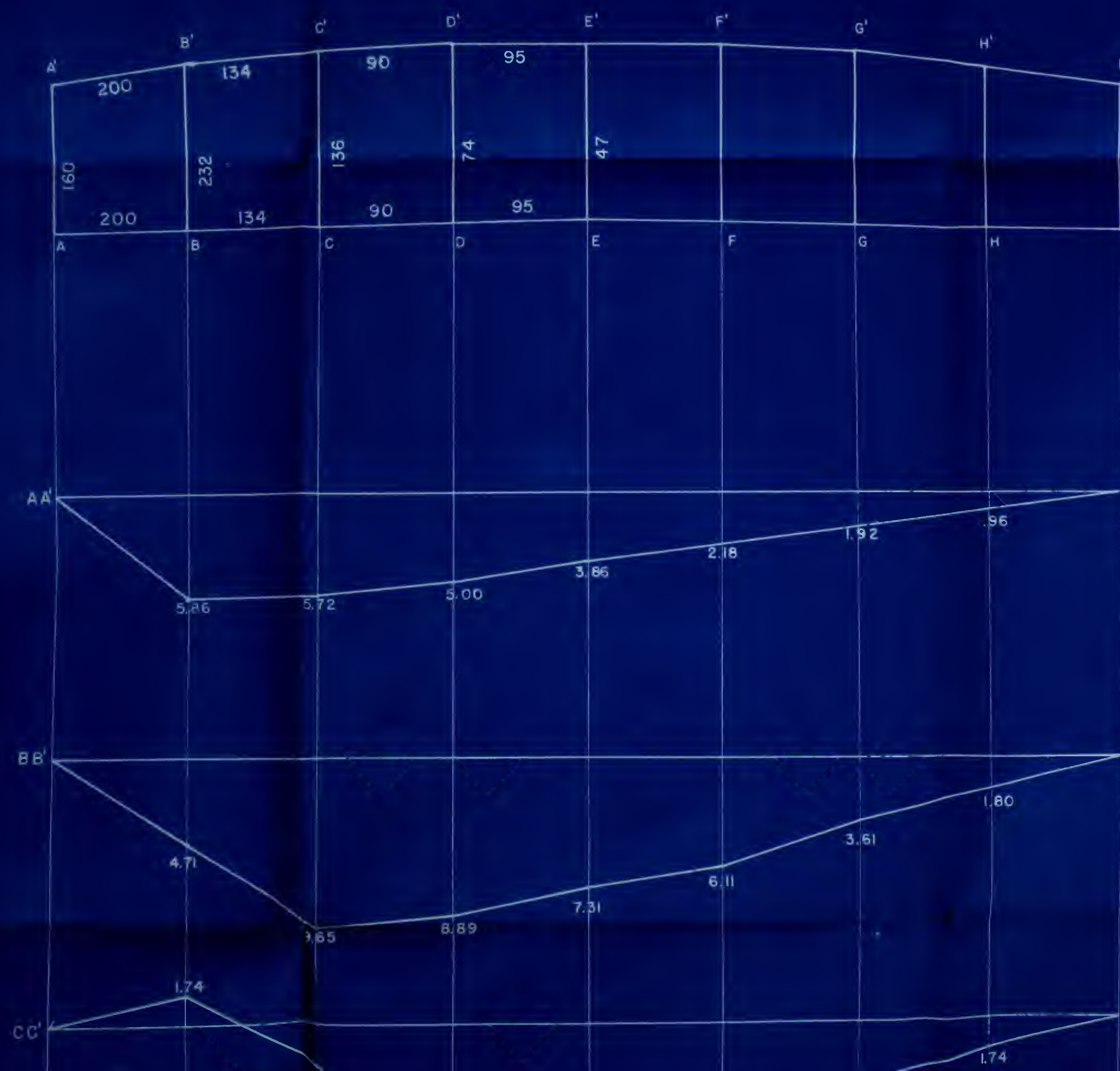

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134
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232
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AA'
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BB'
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BB'
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CC'
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1.74
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EE'
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3.60
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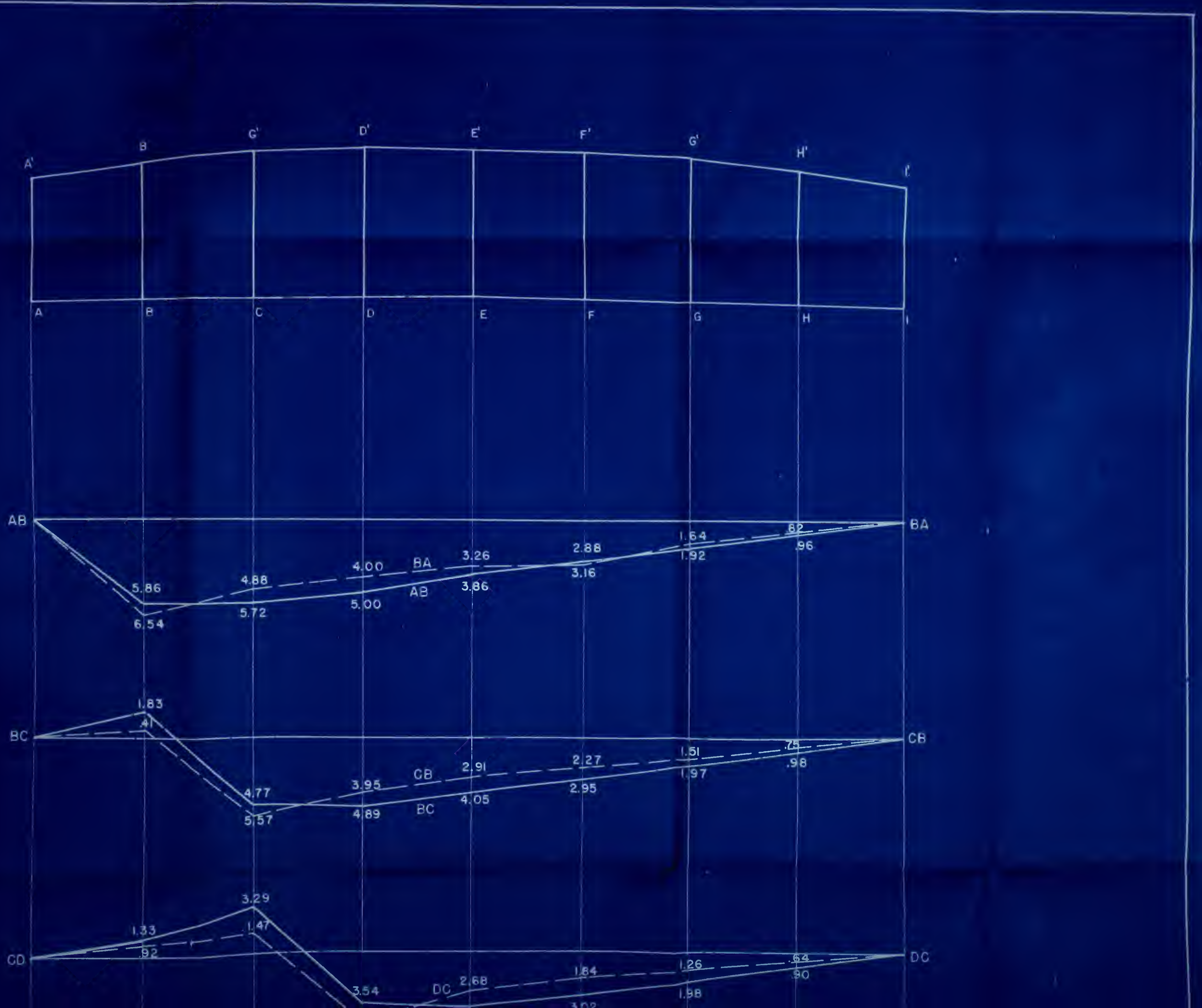

A' B' C' D' E' F' G' H' I'
A B C D E F G H I
AB BA
5.86 4.88 4.00 BA 3.26 2.88 1.64 .82
6.54 5.72 5.00 AB 3.86 3.16 1.92 .96
BC CB
1.83 .41
4.77 3.95 CB 2.91 2.27 1.51 .75
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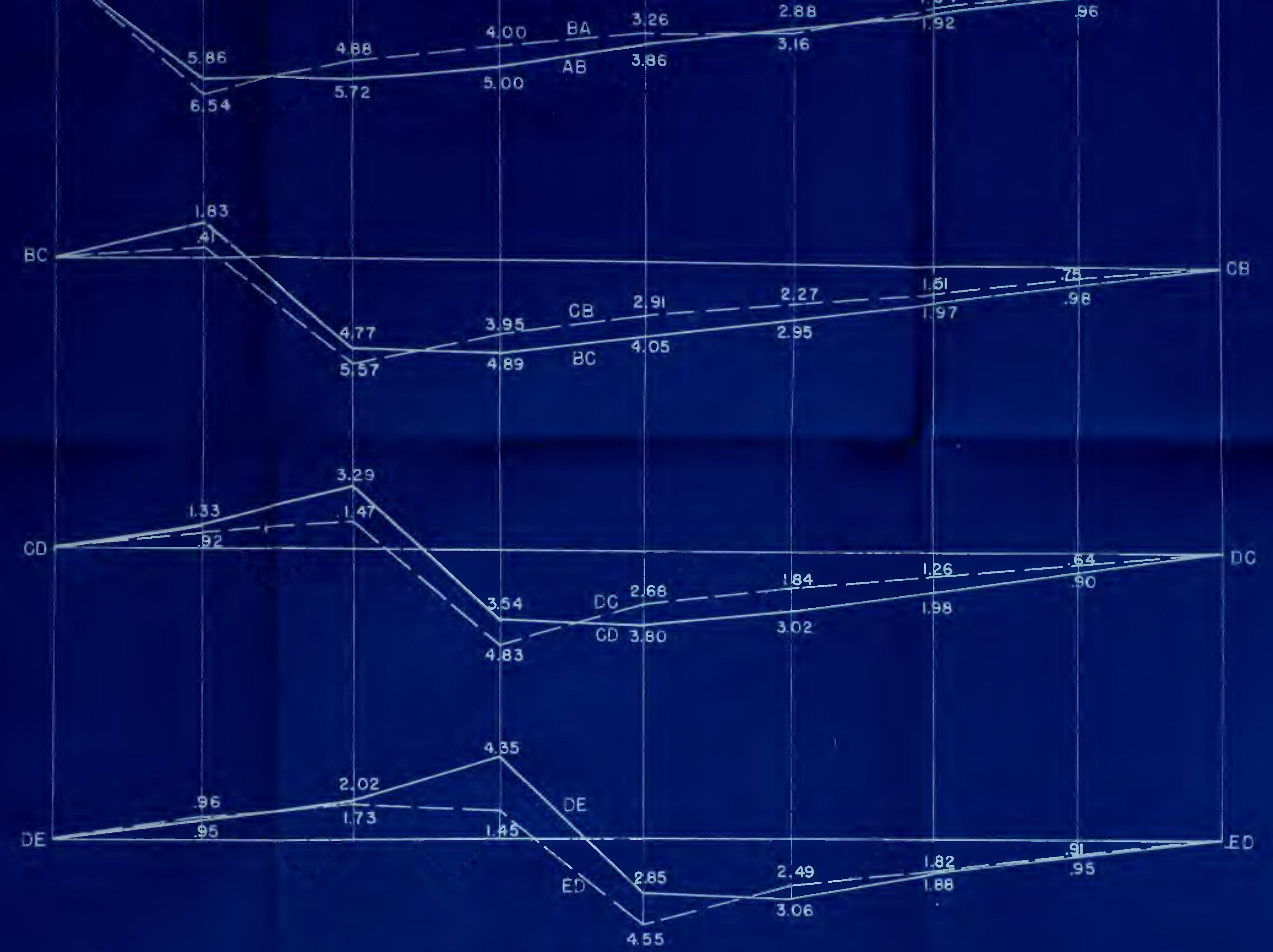

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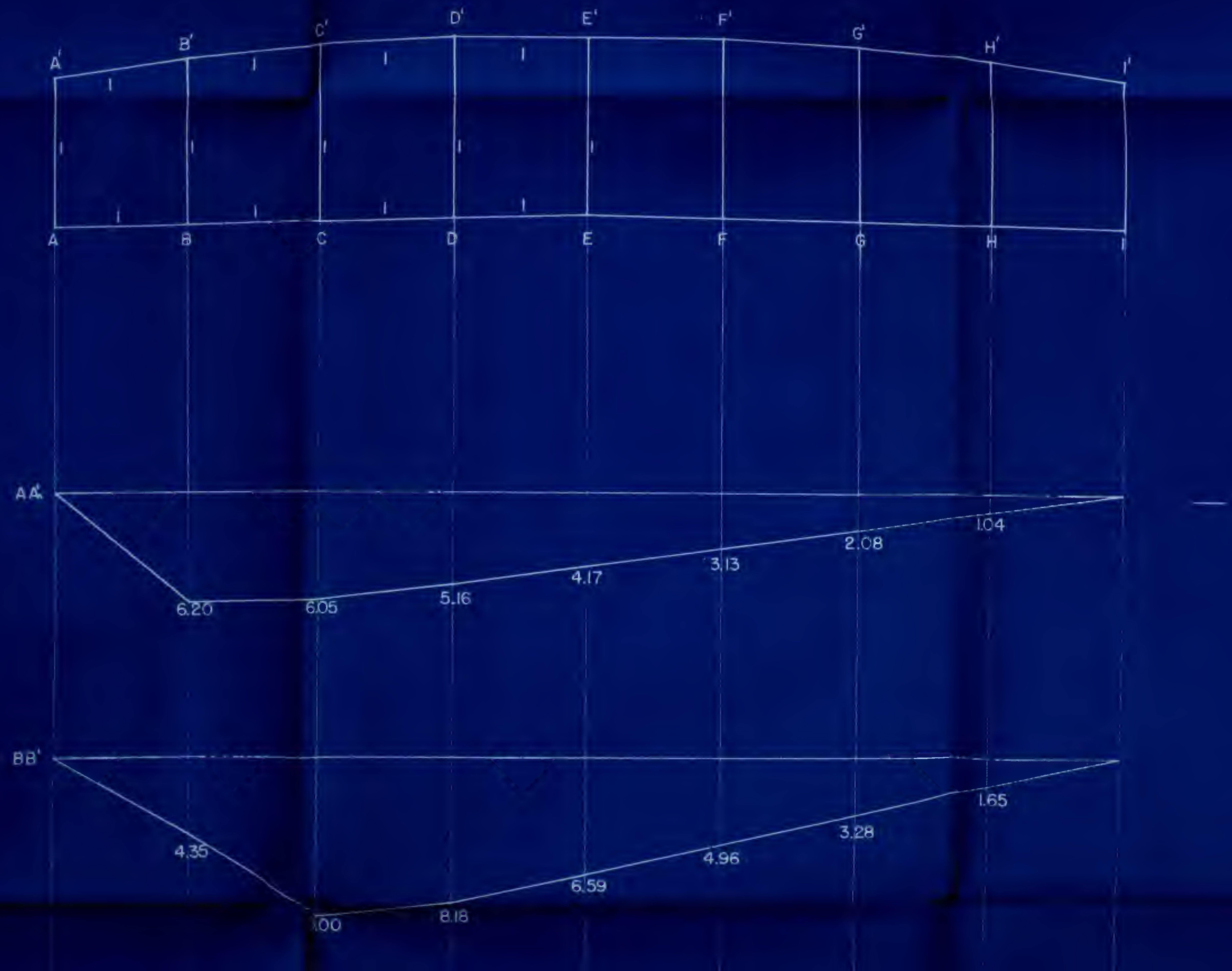
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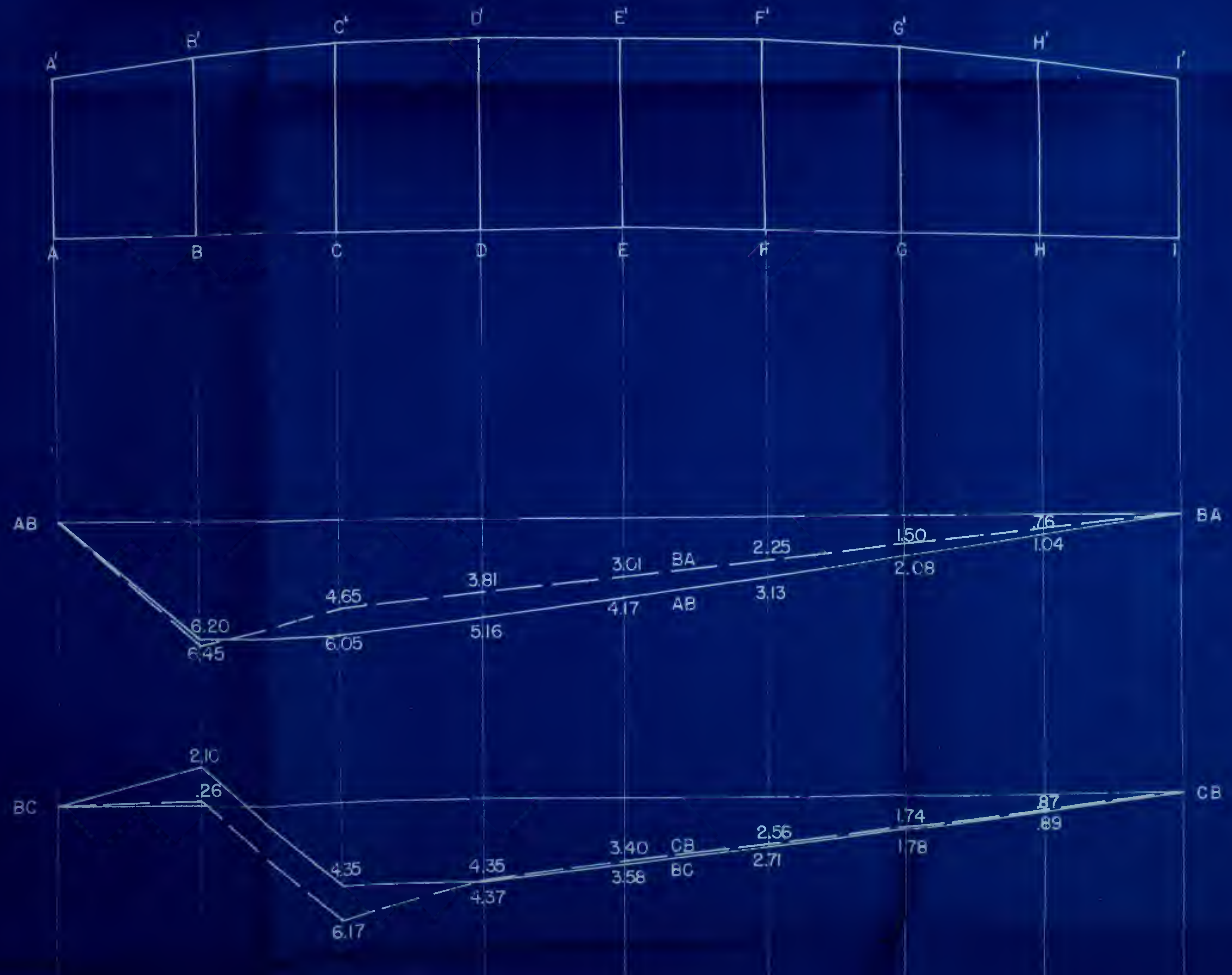

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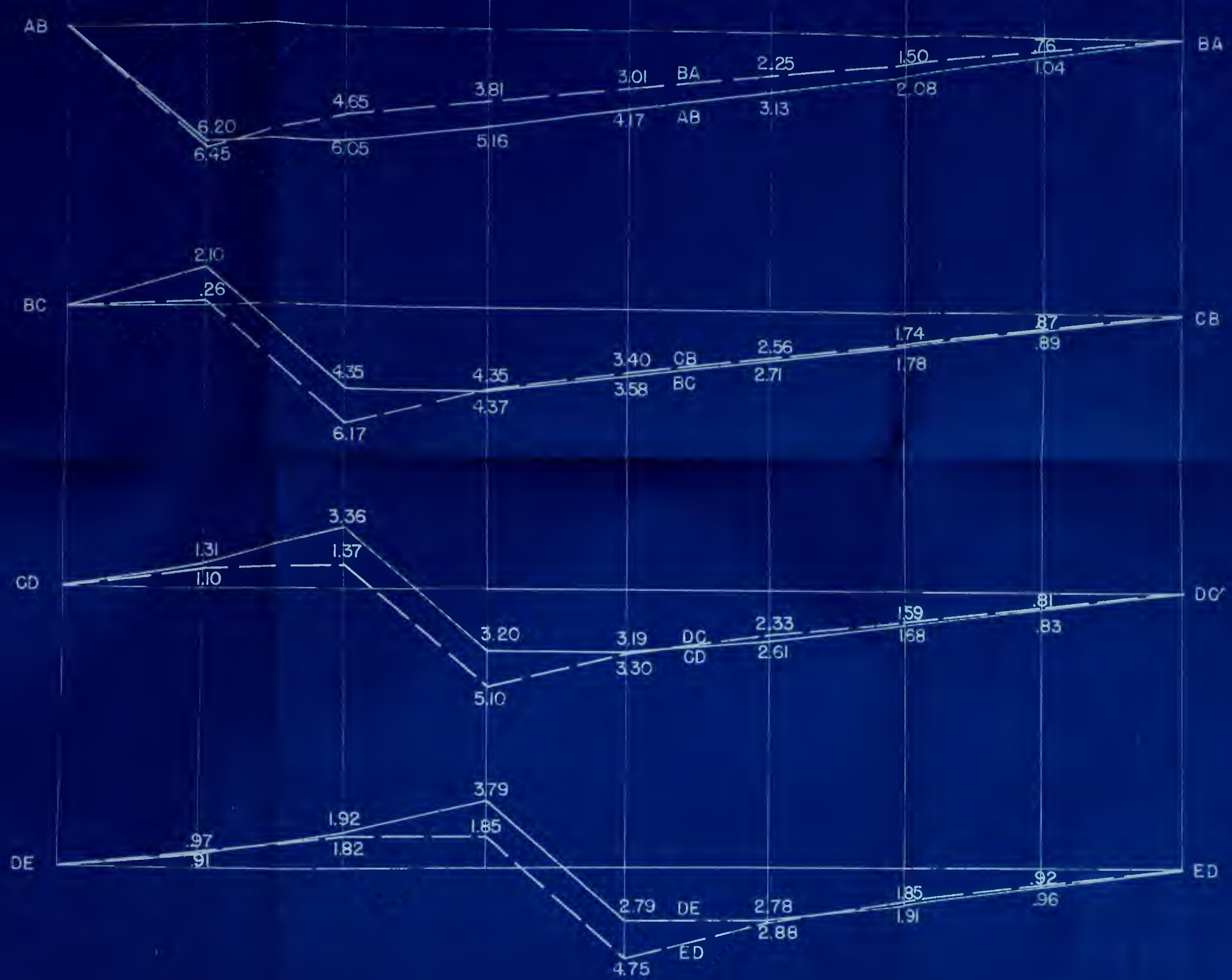

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THIRD SET

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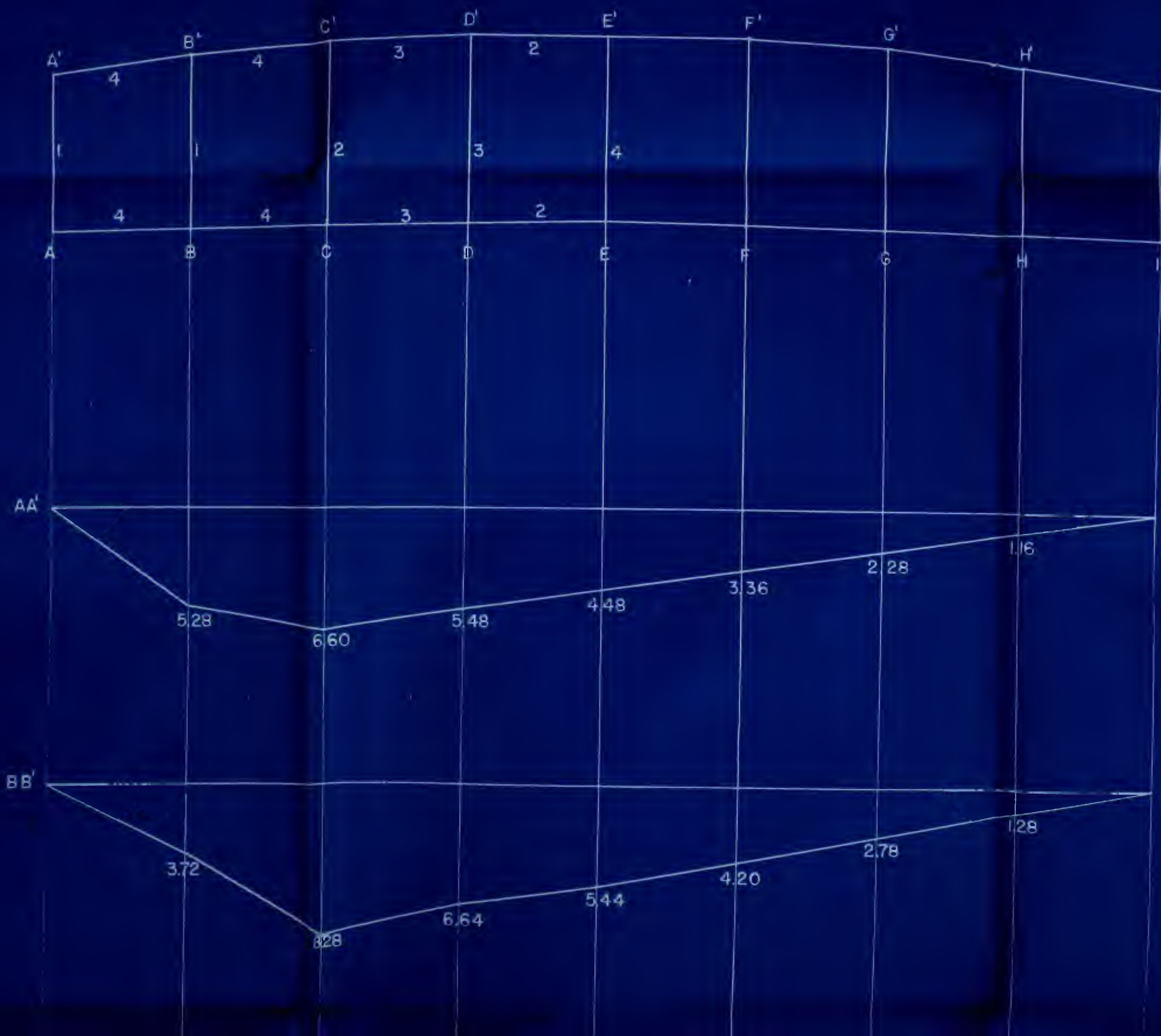

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AA'
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BB'
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BB'
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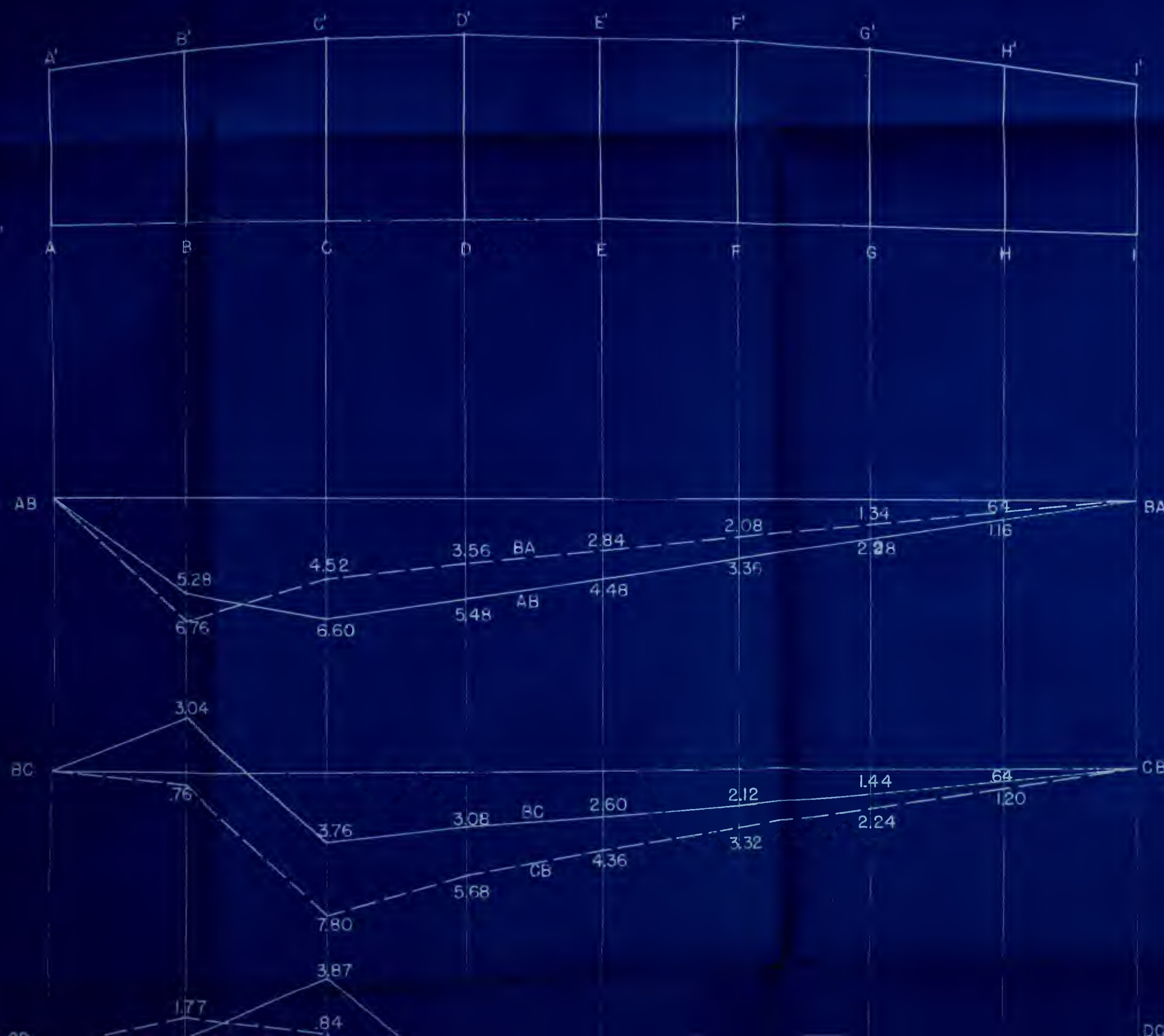

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5.68
BC
CB
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1.44
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.64
1.20
3.87
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DC

INFLUENCE LINES

FOURTH SET

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Thesis 6889
M3 Manning
Investigation of the
effect of stiffness of
members upon the solution
of Vierendeel trusses.